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Working Capital in Street-Lighting Service

CENTRAL STATIONS will find the question of working capital allowance in relation to street-lighting service of special interest whenever attempts are made to ascertain the cost of furnishing the latter on a broad scale, including fixed charges as well as operating expenses. Opponents of existing rates naturally will seek to reduce the working capital allowance to its lowest terms. What sort of items may properly be included in this connection in the case of a company which supplies street-lighting service in a number of separate municipalities?

We need not list these items in complete detail, but may point out that some reserve in supplies applicable to street lighting may fairly be claimed from the coal pile to the stockroom and from the company laboratory or testing department to the motor or horse-drawn vehicles used in maintenance. The municipal officer striving to reduce rates may very likely contend that the proportion of the street-lighting demand to the total peak in kilowatts is relatively low and that the street lighting could safely be furnished if no allowance for coal reserve should be included in its cost. Any such contention should be resisted. The coal reserve applies to all classes of service without discrimination; it must be figured upon the probable total demands and outputs placed upon the company in any given period, and no sound economic reason exists for skimping this reserve in a well-managed company. In reality, the illumination of the public streets is more important than its load ratio indicates, and we are inclined to believe that in case of a fuel shortage, one of the last classes of loads which the public authorities would permit the company to drop would be this one.

Spare cable, overhead wire, poles, cross-arms, etc., must be carried for street lighting on a continuous basis. The No. 6 wire in particular, so commonly used in series circuits, levies a substantial carrying charge against the stores department. While no careful and fair-minded manager would charge one municipality with the spare overhead or underground line material necessary to maintain service in another such town against another where the rate in force is not being investigated, some consideration should be given to the fact that the requirement of such spare equipment in diverse places is an advantage to the single city or town through the emergency supplies rendered available. In other words, if a company supplied a street-lighting load in but one town, other things being equal, the relative amount of spare equipment to be maintained on hand would probably be greater by a substantial amount than is the case where a number of municipalities are concerned. This economic advantage of serving a group of communities makes it all the more important for the single municipality under discussion to recognize the fairness of a working capital allowance for spare equipment devoted to its own needs, with due appreciation of what might be called the diversity-factor of the reserve investment.

Similarly, a fair allowance should be made for the ready money needed to maintain a modest-sized engineering or drafting branch of the staff; for carrying on the office work associated with pole locations, lamp sites, installation of manholes and conduit, acquisition of permits, spare parts for motorcycles used in inspection, etc. As a practical matter, no doubt the street-lighting business of even a large company could be conducted for quite a period with the facilities in office organization and stockroom plant (exclusive of specialized apparatus useless for other service) normally applicable to the general business of the company; but a fair allocation of costs charges the street-lighting service with a measure of these facilities. If such charges are not permitted, they must be carried by the other classes of consumers of the company's service; and clearly the general taxpayer of the community served is the proper source of revenue, rather than the general lighting or power customer, when it comes to the illumination of the public streets. Without carrying these cost classifications to absurd lengths, the central-station manager may rightfully "get up on his hind legs" and demand that a working capital allowance is just as fair for the single street-lighting customer represented in the city or town, as it is for any other user of the service furnished by the company.

More Complete Cost Data Needed

THE compilation of cost data bearing upon transmission-line construction is a comparatively simple engineering problem, thanks to the clear-cut demarcation of material devoted to this work in particular instances. Here the engineer deals with what might be called trunk-line conditions; the structures involved in high-potential transmission are as a rule distinct from other property used in company service, and even where outdoor switching facilities are provided, it should not be difficult to segregate the line and related investments with great accuracy.

Even if the cost of such work is approximated at junction and terminal points, the length of wire usually concerned in the line proper and the extensive duplication of steel towers, foundations or poles, with the standard insulator types, etc., are so great that it is on the whole an easy task to analyze construction costs.

The situation is otherwise on the ordinary distribution system. Piecemeal construction is the inevitable result of commercial development, and with the most careful planning with reference to neighborhood growth and prospective industrial conditions, it is still necessary to cut the cloth to fit the coat. Changes in load demands also enter the problem, requiring more or less frequent alterations of line capacity, reconstruction of branch-offs and reinforcement of existing facilities. The utilization of spare pins and crossarms comes into the case, and too often, indeed, the desirable cost data become hopelessly bemired in inadequate records and system complications.

Fortunately this situation can be remedied in many companies, perhaps not with respect to former construction, but certainly in carrying forward new work. Some improvement can be attained by remodeling the time slips used by line foremen so as to subdivide the record of material and labor more completely. It is doubtful indeed if it is worth while to apply the inquisition of unit-cost analysis to every line maintenance or reconstruction job. What is needed is not a continuous analysis of all distribution work, but enough data to enable reasonable conclusions to be drawn as to representative costs per mile or per block of stated length of single-phase and three-phase distribution in different sizes of copper and with different pole heights, spacings, etc.

It would be expecting too much at this time to look for unit data on the cost of networks, other than very broad figures ranging about a per capita served and a per square mile of territory basis. Again we say that what is needed is not this sort of information so much as straightaway costs accumulated over a sufficient range to afford some reasonable basis of judging whether existing cost data submitted to commissions in rate or capitalization cases are reasonable. Too often, in such cases, one finds on examining the docket of evidence presented the commission, that distribution costs are given merely in lump sums covering so many miles of No. 4 wire erected in a given territory, so many poles placed, and so much money expended on system alterations in town A. We appreciate the difficulty of inducing the average line foreman to keep his field records in a form that will permit an engineering audit after the aforesaid sheets are filed in the office.

In some cases, we understand, it has been found practicable to require pencil sketches of line construction completed under a stated cost outlay by the foremen and their crews. If this work is handled faithfully, at least on important jobs, much information of value can be gained, but we commend to the central-station engineer desiring to acquire more accurate distribution-system cost data that he follow the matter personally for a time and by realizing the limitations of field sheets as ordinarily provided see to it that more complete and above all more representative costs go into his files. To attempt to evaluate accurately the unit costs of existing complex networks where insufficient records exist is a staggering task unless a standard appraisal is undertaken; but in place of this, the engineer interested in obtaining better figures can accomplish a vast amount of good work if he confines his efforts to the study of significant pieces of construction and maintenance.

Engineering Charges in Underground Construction

AT a recent commission hearing the question arose as to the scope of engineering charges in connection with underground construction. The justification of such charges was not denied by the board, but from the early course of the testimony it appeared that the commission was somewhat in doubt as to the necessity for charges of the order of magnitude involved in the case. After the hearing, a supplementary statement was sent to the board by the company in which the character of engineering service associated with underground line construction was set forth.

This statement pointed out that engineering ability of a high order is needed in planning and executing this class of construction. Preliminary surveys are made with great care in planning such work, showing in the practice of the local company concerned every building in the territory specified which now or in the future is likely to be served by underground lines. Accurate and complete knowledge of existing underground structures is most important before taking up detailed estimates of cost no less than in immediate advance of excavation. Experienced engineering ability is required in many cases in securing rights of way for conduit structures from municipalities. Technical judgment of a high order is needed in planning lines of conduit development deciding duct and cable materials, sizes, test requirements, spare capacity and determining probable costs. The ultimate cost of engineering mistakes in this class of work is very serious on account of the difficulty of rectifying errors. While some contractors maintain engineering organizations, others do not, and at every stage of the work from the estimate sheet to the backfilling and repaving, if any, the judgment of the engineer is essential to the proper solution of the problems of underground line construction. Success in such work is far more than making a few rough stretches of duct route locations on superficial maps and trusting to the foremen and crew of the field force for the rest, and a liberal engineering charge should be allowed to insure it.

HAPPENINGS IN THE INDUSTRY

Dallas Voters Approve New Utility Franchises by Overwhelming Majority—National Association of Electrical Inspectors Holds Annual Convention—Damages Asked by Manufacturer from Electrical Committee—Program for Schenectady Meeting—Electrics in New York Parade—Program for Pacific Coast Convention—Miscellaneous News Notes

DALLAS VOTERS APPROVE NEW UTILITY FRANCHISES.

Referendum Vote Confirms Action of City Commission By Large Majority.

The Dallas (Tex.) City Commission last January submitted to vote of the taxpayers the proposition of granting franchises for organizing a proposed new electric-lighting and street-railway company in Dallas. The election held April 3 confirmed the franchises by a large majority and is considered an overwhelming victory for the utility companies. The franchises have already been granted by the commission and the vote upon them was in the nature of a referendum. Immediately upon granting the franchises, the attorneys for J. F. Strickland, who will head the new lighting company, and C. W. Hobson, head of the new street railway company, filed bonds in the amount of $1,000,000 to guarantee to the city the carrying out of specified agreements to comply with the ordinances. There were four surety bonds, as follows:

"J. F. Strickland and his associates will pay to the city of Dallas the sum of $250,000 for failure to make $2,000,000 worth of improvements to the light and power properties in Dallas."

"C. W. Hobson and his associates will pay to the city of Dallas the sum of $200,000 for the failure to make improvements, extensions and betterments to the amount of $1,000,000 on the street railway lines."

"C. W. Hobson and his associates will pay to the city of Dallas the sum of $200,000 in case of their failure to construct a new interurban at least 30 miles long, with Dallas as a terminus, work to begin on the new lines within six months after the new company begins operations."

"C. W. Hobson and his associates will pay to the city of Dallas the sum of $350,000 in case of failure to construct into Dallas a second interurban line not less than 30 miles in length, provided the revenues of the street railway company reach an amount equal to specified contract terms."

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS HOLDS CONVENTION.

Biennial Meeting in New York City Discusses Status of the Inspector.

The biennial convention of the National Association of Electrical Inspectors was held at New York City, March 27. In spite of very stormy weather there was a good attendance and considerable was accomplished. At the election of officers, Washington Devereux, chief inspector of the Philadelphia Board of Fire Underwriters, was elected president, and John W. Kelly, Jr., chief of the electrical department of the city of Camden, N. J., was elected vice-president. These two gentlemen are already developing some important plans of far-reaching scope which it is believed will be of great benefit to the Association. William Lincoln Smith and R. P. Strong were re-elected to their present positions as secretary-treasurer and representative on the Electrical Committee, N. F. P. A.

Retiring president, H. S. Wynkoop, took for the subject of his address "Breadth of Vision in Inspection Work," calling attention to the motto of the Association "Let the Code Decide." He referred to the strong adherence of the Association to the National Electrical Code and to those who have established and now enforce it. Mr. Wynkoop made a strong plea for broadmindedness among the electrical inspection fraternity, particularly in regard to interpretation of the Code. This requires a number of characteristics, among which are thorough knowledge of construction problems, origin of Code requirements and knowledge of how they are being worked out in the field, what the opinion of manufacturers and contractors is regarding them, etc. The inspector must ever be on the alert to learn what others think, says and do electrically. He must not get into a rut. He must think extensively and look at problems from all angles. It must be remembered that all statutes, ordinances and standards of practice are averages or compromises. They are based on what is deemed the good of the many rather than the good of a few. The National Electrical Code is no exception to this rule. The inspector must know not only the spirit of the Code, but must also be able to interpret this spirit for the benefit of others. Mr. Wynkoop urged that inspectors read some good electrical paper every week, hold membership in some inspectors' association, and improve their opportunity to listen to experiences and arguments diametrically opposed to their own.

The banquet held on Tuesday evening was well attended. There were several inspiring addresses, one by Louis Kalischer, chairman of the advisory board, National Electrical Contractors' Association, another by T. Comerford Martin, secretary, National Electric Light Association, and a third prepared by Howard R. Sargent, managing engineer of the wiring supplies department of the General Electric Company; Mr. Sargent was unable to be present so his remarks were read by Alfred E. Braddell, of New York City.

Mr. Kalischer called attention to the frequent differences between inspectors and contractors which, however, are being smoothed out, in New York City, at least. The older inspectors who were recruited from the ranks of journeymen electricians and have first-hand knowledge of the conditions rarely condemn the contractor; but the new "cub" inspector who attempts to apply theoretical or academic considerations to every detail of the work is the cause of considerable friction. It was urged that such inspectors should submit their criticisms direct to the contractor or to the head of the inspection department and not to the customer for whom the work is being done. Contractors are very eager to see inspection broadened so as to cover rigid inspection of all work, both new and old, this being very difficult on account of the limited number of inspectors and the still more limited funds available.

Mr. Sargent's address discussed the subject of electrical inspection from the manufacturer's point of view, showing that the most progressive manufacturers of electrical devices co-operate freely with the factory inspectors of the Underwriters' Laboratories because this maintains the product up to the highest standard and enables them to secure valuable ideas for the improvement of the devices. A difficulty arises, however, from the different requirements of the various inspection departments.

DAMAGES ASKED BY MANUFACTURER FROM ELECTRICAL COMMITTEE.

Action Brought Against Electrical Committee of National Fire Protection Association Carries Claims for $500,000 Against Each Member.

Adjournment of the biennial meeting of the Electrical Committee, National Fire Protection Association, immediately after convening in New York on March 28 was explained by the following resolution which was adopted just after the meeting opened:

"Whereas the maker of a certain electrical service device has brought suit in the New York Supreme Court against all the members of this committee and has obtained a restraining order which not only enjoins the committee as a body from taking any action disapproving of this device, but prevents us as individuals from saying or doing anything which any person might interpret as being unfavorable to the device; and

"Whereas we have engaged counsel to protect our interests in the litigation and have been advised by the counsel that the character of the restraining order is such as to render inadvisable any general discussion at this time of any subject that may come before the committee,

"Be it therefore resolved, that the committee now adjourn subject to the call of the chairman."

Justice Delehanty, of the New York Supreme Court, on the application of the Economy Fuse & Manufacturing Company, had issued a restraining order in the following general terms:

The order served restrained the defendants, both individually and as switch and cut-out committee and as electrical committee, their agents, servants, employees, attorneys and agencies through which they act, from taking any vote, passing any resolution, doing any act or having any communication, either oral or written, the purpose or the effect of which will be or that will cause or tend to cause:

(1) The customers of the Economy Fuse & Manufacturing Company to break contracts to purchase fuses from said company.

(2) The customers of the Economy Fuse & Manufacturing Company to refuse to renew contracts to purchase fuses from said company.

(3) Persons, firms or corporations desirous of becoming customers of the Economy Fuse & Manufacturing Company from making contracts for the purchase of Economy fuses.

(4) Any persons, firms or corporations using fuses or about to use fuses to infer that said defendants either individually or as members of either of said committees have condemned the Economy fuse as a fire hazard, a dangerous device or one which it is not proper to use.

(5) Any persons, firms or corporations using fuses or about to use fuses to believe that the Economy fuse is a dangerous and hazardous device.

(6) The withdrawal or annulment of permission or permissions heretofore granted for the sale and purchase, installment and use of the Economy fuse.

(7) Refusals to grant further permissions in the future to purchase and sell, install and use Economy fuses.

(8) Or to call, or that will call or tend to call, attention to the fact that the fuse manufactured by the Economy Fuse & Manufacturing Company is not recognized by the defendants' National Electrical Code; and

(9) Or that will be to declare or lead others to believe that the Economy fuse is not a proper device to be recognized by said defendants' National Electrical Code, or the purpose or effect of which will be to discriminate against the Economy fuses in favor of the fuses of competitors of the Economy Fuse & Manufacturing Company.

Argument on the injunction was heard March 29, the Economy Fuse & Manufacturing Company being represented by Frank H. Platt, of Platt & Field, and the defendants by Attorney Rand. The court took the matter of continuing the injunction in force under advisement and at the time of going to press no decision has been handed down.

The basis of the complaint of the Economy Fuse & Manufacturing Company was that the defendants, as the Electrical Committee, have been unlawfully interfering with their business for the past five years; that though the plaintiff had sought time and again to demonstrate to the members of the committee the desirability of their fuses and that they had been tested and reported on as complying with the performance required of the National Electrical Code by the Underwriters Laboratories, Inc., and the Underwriters Laboratories had recommended to the committee that the Economy renewable fuse was a device meriting their serious attention for recognition, members of the committee had not made any proper investigation of the subject, and though a large number of them had expressed their approval of the plaintiff's fuse individually, they were about to act in concert with other members of the committee to adopt a resolution which the plaintiff claimed was in effect a definite judgment that the Economy fuse should not be recognized.

The plaintiff alleged that this action was the result of animus against it on the part of certain members of the committee and was not justified by the facts, as experienced with the use of the Economy fuse in all sorts of conditions and service, and under test had demonstrated beyond a doubt that the device was one of great merit. The complaint was intended to show that the fuse was being used in large quantities by some of the largest and most substantial railroads and business houses in the United States, and that they had over 20,000 customers and had sold by virtue of special permission granted by certain of the defendants upward of 10,000,000 fuses and links during the past year; the complaint also alleging that its business would have been vastly in excess of this amount were it not for the action of the other members of the committee. The plaintiffs laid the blame largely at the doors of those members of the committee who lived in and around Boston, stating that all the members of the committee, excepting these, had permitted the use of the fuse, whereas these had attempted to prohibit the sale and use of Economy fuses, thus denying themselves of ability to judge of its merit, which was contrary to the spirit of the resolution passed by the Electrical Committee at its last biennial session.

Much stress was laid by the plaintiff on the fact that it was demonstrated at the 1915 meeting that the action of the Electrical Committee in making and changing the National Electrical Code was controlled by an open mass meeting, at which the public and the competitors of the plaintiff participated, and showed that the action of the committee as a whole was repudiated in the face of the committee's own vote against it.

The action of the manufacturer carries with it claims for damages of $500,000 against each individual member of the committee.

PROGRAM FOR SCHENECTADY A. I. E. E. MEETING.

To Be Held Under Auspices of Standards Committee on April 13.

The three hundred and thirty-first meeting of the American Institute of Electrical Engineers will be held in Schenectady, N. Y., April 13. The Institute headquarters during the meeting will be in the Edison Club, 60 Washington Avenue. The meeting will be under the auspices of the Standards Committee.

A paper on "Temperature Corrections" will be presented by V. M. Montsinger of the General Electric Company. Four other papers bearing on allied subjects will be presented for discussion. They are as follows: "Temperature Distribution in Electrical Machinery," by B. G. Lamme; "Rational Temperature Guarantees for Large Alternating-Current Generators," by F. D. Newbury; "Internal Temperatures of Alternating-Current Generators," by Ralph Kelly, and "Electrical Machinery Tests and Specifications Based on Modern Standards," by H. M. Hobart.

ELECTRIC VEHICLES FORM IMPORTANT FEATURE OF NEW YORK PARADE.

Guests of Honor at Meeting of National Guard Association Conveyed in 20 Automobiles.

Electric passenger automobiles came in for the lion's share of honors at the National Defense Convention, held in New York City last week under the auspices of the National Guard Association of the United States. Escorted by the entire Seventy-first Infantry, which had already been mobilized at its armory, more than 50 prominent persons paraded up Fifth Avenue in 20 of the latest models of electric autos. A mounted detachment of police brought up the rear.

This is probably the first time in the history of parades in New York that such extensive use of the electric car has been made. Twenty vehicles were in the line and among their distinguished passengers were Governor Whitman, Mayor Mitchel, former Justice Hughes, Major-General Leonard Wood, Major-General O'Ryan and State and National Guard officers from all over the country.

The cars were secured for the purpose by the New York Electric Vehicle Association following a request from Brig. General George R. Dyer, chairman of the Committee of Arrangements. The Association secured some of the cars from owners who were willing to have them used in the interest of National Defense and others were borrowed from shows rooms of the Detroit and Baker R. and L. Companies.

Because of the ease of control so characteristic of the electric, perfect alignment was maintained through the march. The cars three abreast were operated at a uniform speed that just matched the pace of the marching infantrymen of the escorting regiment. There was no stopping or stalling and at the end of the parade the guests were quite outspoken in their praise of this type of vehicle for city military purposes.

PROGRAM FOR PACIFIC COAST NATIONAL ELECTRIC LIGHT ASSOCIATION MEETING.

First Annual Convention to Be Held at Riverside, Cal., April 19-21.

The first annual convention of the Pacific Coast Section of the National Electric Light Association will be held at the Mission Inn., Riverside, Cal., April 19, 20 and 21.

The first session on April 19 will be devoted to addresses of welcome and reports of numerous committees. The afternoon session will be under the auspices of the Commercial Committee and the discussion will deal with rates, merchandising of lamp-socket devices, electric cooking and water heating, and highway lighting. In the evening there will be an illustrated address on the Southern Sierras Power Company's system by C. O. Poole.

The topics for consideration at the first session on Friday include industrial electric heating and commercial organization. The afternoon session will be under the auspices of the Engineering Committee and the following subjects will be considered: Standardization of distribution transformers; report of conference with engineers of California Railroad Commission on general safety order affecting line construction; suspension insulators; standardization of pin and clevise hardware for suspension insulators; inductive interference; fuse protection of transformers and branch lines in rural distributing systems; joint pole construction; operation of steam-turbine standby station, and high-head water wheels.

In the evening the report of the Public Policy Committee will be presented and there will be addresses by Max Thelan, president of the California Railroad Commission; John S. Mitchell, of the Los Angeles Chamber of Commerce; O. B. Coldwell, representing the Northwest Electric Light and Power Association, and H. M. Byllesby, of Chicago. There will also be an illustrated lecture by W. D'Arcy Ryan.

Saturday and Sunday will be given over to numerous entertainment features and inspection trips to neighboring hydroelectric plants.

A. H. Halloran, of San Francisco, is secretary of the Section.

CONFERENCE OF ENGINEERING SOCIETIES FOR CLOSER CO-OPERATION.

Two-Day Meeting and Banquet in Chicago To Promote Co-operation in Peace and War.

Representatives from 38 national and local engineering societies throughout the country met in Chicago on March 29 and 30 for the purpose of holding the third conference of engineering co-operation. A considerable number of subjects aiming at co-operation of engineers, both in times of peace and war, were freely discussed, and important recommendations made, which space does not permit giving here at length. Special action was taken to secure more hearty co-operation among engineers with the country's naval and military services in view of the present national emergency, and the formation of the Engineering Officers' Reserve Corps was given an impetus. The proposal to form an engineering council was heartily endorsed, but it was recommended that this be broadened so as to include representatives of not only the principal national engineering societies, but also the more prominent state and local engineering organizations.

In connection with the meeting a banquet was tendered the delegates to the conference by the engineering societies of Chicago; this was held on the evening of March 29. F. N. Newell, chairman of the conference, acted as chairman at the dinner, and E. H. Lewis was toastmaster. Addresses were made by Gardner S. Williams, H. M. Byllesby, F. J. Lewellyn, Morris L. Cooke and Garrison Babcock. Professor Newell spoke of the objects of the conference, and Mr. Williams emphasized the fact that in all proposed co-operative action every engineer must do his part. Mr. Byllesby cited many illustrious examples of national leaders who had received engineering training. He defined the essentials and characteristics of the engineer as involving integrity of thinking, persistent and untiring toil, keen imagination and hopefulness. He made an earnest and inspiring plea for the engineers to co-operate in active measures for preparing national defense.

Mr. Cooke urged that engineering co-operation should bring about the unification of the aims and policies of engineers in the same way as has been done by the professions of lawyers, doctors and architects. He cited experiences in Philadelphia with the local chapter of the American Institute of Architects as showing liberal and prompt co-operation by architects in municipal problems dealing with architectural matters. Similiar co-operation is desirable in the engineering work of municipalities, which is one of the principal activities undertaken by them. Discussing the subject of co-operation among the national engineering societies, he pointed out what he considered to be the poor plan of their organization. In order to bring about effective co-operation among these societies democratic organization was essential. Mr. Babcock, president of the American Association of Engineers, also spoke earnestly in behalf of immediate preparation for national defense. Mr. Lewellyn mentioned the proposed Engineers Building, on Federal Street, in Chicago, which, if carried out according to the plans, will become not only the business and meeting headquarters of the engineering societies in Chicago, but also of their social activities. The present plan is to replace the building of the Chicago Engineers' Club by a new 12-story building.

MUNICIPAL OWNERSHIP NOT A SUCCESS.

Chicago Editor Explains How the Public Ownership Theory Has Failed in Some 200 Communities.

Speaking before the Electric Club-Jovian League of Chicago, at its regular meeting on March 29, James B. Wootan, managing editor of *Public Service*, stated that under our present "spoils" system, public ownership of utilities was impossible and he cited examples showing how the theory of public ownership had fallen down in actual practice in some 200 communities. Particular reference was made to the distribution of municipal-ownership propaganda by those interested in it and to the misleading character of this literature because of the lack of all the facts. In this connection reference is made to the Winnipeg situation, Mr. Wootan stating that, "in this publicity, which is being used by a good many newspapers, Winnipeg's three-cent electric lighting plant is just now made a 'leader.' For instance, the propagandist goes on to show that while some privately-owned plant in some American city is charging at the rate of say, six cents per kilowatt-hour, Winnipeg's municipal plant is supplying the private consumer at just half that figure.

"No attempt is made to explain why Winnipeg is able to maintain a three-cent rate. But the general manager of the Winnipeg municipal system, J. G. Glassco, explains why Winnipeg's plant is able to maintain a three-cent rate. He sets forth the fact that this is a hydroelectric plant and therefore is able to produce power for much less than a steam plant could. After presenting a comparison in figures, the general manager says that the City of Winnipeg would have to very much increase its present rates if they were selling electricity generated by steam rather than by hydraulic power."

Here is a table of comparison presented by Mr. Glassco, showing the present hydroelectric costs as compared to the costs if energy was produced in a steam station:

	City present development	Steam equivalent 30,000 kilowatts
Capital investment	$4,000,000.00	$2,250,000.00
Fixed charges at seven per cent	280,000.00	247,500.00
Operating expense	120,000.00	650,000.00
Total annual expense	400,000.00	897,500.00
Total kilowatt-hours	60,000	60,000
Cost per kilowatt-hour	0.66	1.49
Distribution cost	0.78	0.78
Total cost	1.44	2.27
Yearly load-factor	0.41	0.41

Central-Station Service Found More Economical Than Private Plant.

The Buffalo, Rochester & Pittsburgh Railway's power house at Rochester will soon be shut down and the entire power load will be connected to the Rochester (N. Y.) Railway & Light Company's lines. The car-repair shops, round house, coal hoists, transfer tables and the machine shops are all to be supplied with central-station service.

In addition to the power load, the lighting of the extensive railroad yards requires considerable electricity, the average day load being 150 kilowatts and the night load 75 kilowatts. While most of the power is used at the shops, part of it is used to operate an air-compressor plant at Brooks Avenue, 1.5 miles away.

The present power plant generates two-phase electricity at 230 volts which is raised to 2,300 volts for distribution about the yards and also to the Brooks Avenue plant. As the Rochester company's voltage is 4,100 volts and that of the Buffalo, Rochester & Pittsburgh Railway is 2,300 volts, special transformer connections will be required. Temporarily, this voltage will be supplied by two banks of transformers, the first bank being connected in star-delta to reduce the voltage to 230 volts, and the second bank will be connected delta-delta to raise this voltage from 230 volts to 2,300 volts. The permanent installation, however, will consist of an auto-transformer which will transform the voltage from 4,1000 volts direct to 2,300 volts.

UTILITY OPERATING RATIO HAS MADE BIG ADVANCE.

Reports Show That While Gross Revenues of Companies Are Making Large Gains Net Revenues Are Growing Smaller.

Some disappointment has been expressed by holders of public-utility stocks that these issues have failed to respond to general market conditions and have not only been dull but, in the case of many issues, actually reactionary.

The present trouble with the majority of the electric light and power, electric railway and artificial gas properties is not lack of business, for gross revenues of these companies have never been so high as they now are. It is the high cost of living which has resulted in a steady advance in their ratio of operating costs to gross earnings and a consequent decrease in their net revenues. While it is said by utility managers that the present high operating ratio is expected to be temporary, it is practically certain that it will be much higher in the next two years than formerly.

Utility men are considering the taking of the question of this increased cost before the state commissions and other rate-making bodies and asking for some relief in the way of the granting of increased rates for their service. It is certain that something of this kind must be done as the utility properties cannot face operating conditions with rates based on the operating ratio of two or three years ago.

Electric railways and artificial gas companies are suffering more severely than the electric light and power companies as the tremendous gain in gross revenues of the latter companies has helped them overcome to some extent the much higher operating cost. The electric railways and the gas companies are unable to show any such gross gains as the electric light and power corporations and as a result have sustained heavier losses in their net. Companies with a large amount of hydroelectric capacity have not been affected to any great extent as their labor cost is small and fuel, where there is abundant water to generate power, is not an item with them. Also utilities organizations, with good sources of income other than from their strictly utility properties, have been able to overcome their decreases in utility earnings by these other sources of revenue.

In some instances operating costs have doubled in the last year. The Cleveland Electric Illuminating Company for the first two months of 1917 reported an increase of 101 per cent in operating expenses, the greater part of this being due to an excess cost of $314,600 for coal over the corresponding two months of 1916. The effect of this is seen in the turning of a 29 per cent increase in gross into a decrease of 26 per cent in net.

The Commonwealth Power, Railway & Light Company, Jackson, Mich., operating a large number of properties reported an increase of 29.8 per cent in operating expenses, caused by an excess cost of $100,000 a month for coal. Northern Ohio Electric Corporation paid $45,000 more for coal in February, 1917, than in February, 1916, with the result of a 76 per cent increase in operating costs and the turning of 32.8 per cent gain in gross into a decrease of 5.4 per cent in net.

The Republic Railway & Light, New York, N. Y., for the two months of 1917 paid an excess cost of $74,585 for coal, and operating expenses increased 40 per cent, while a 17.3 per cent gain in gross was turned into a 14 per cent decrease in net. With the electric light and power department of the Philadelphia Company an increase of $141,378 in gross for the month was turned into a decrease of $44,423 in net because of the excess cost of fuel, and while gross of the electric railway department for the first two months

of 1917 increased $1,063,885, there was a decrease of $121,542 in net. The Detroit Edison Company for the first two months of 1917 increased its gross 22.6 per cent but operating expenses increased 33.3 per cent, with the result that there was a gain of but 8.4 per cent in net.

This increase in operating costs has been general over the country, Texas Power & Light showing an increase of 23 per cent in operating expense for February, Kansas Gas & Electric Company an increase of 25 per cent, Philadelphia Rapid Transit an increase of 57 per cent, and so on over the country. In the case of the hydroelectric properties a much better showing is being made. Pacific Gas & Electric, Great Western Power of California, Montana Power, Utah Power & Light, Southern Power, etc., have increased the operating ratio in their electric power departments materially less than the companies which must depend entirely on steam generation of energy.

In one way the high cost of coal has been of benefit to the electric power companies as the cost and the inability to obtain shipments of fuel have caused many industrial plants to abandon the use of their independent power plants and contract for central-station energy. This business will remain with the central-station companies and with a return to normal conditions they will continue to show large gross revenues which, with a lower operating ratio, will mean largely increased net revenues as well. Practically all new power contracts entered into by the central-station companies in the last six months have contained clauses providing for a readjustment of power rates based on the cost of coal used for generation and under these contracts the generating companies should be able to show much better operating results.

ANOTHER NEW MONTHLY EXPORT RECORD.

Government Statistics Show January Exports Three Per Cent Greater Than Highest Month.

The record total in the value of electrical exports from the United States reached last December was exceeded during January by over three per cent. The January total was about 112 per cent greater than that of January, 1916. These facts are shown from the official monthly summary of the foreign commerce of the United States, just published by the Bureau of Foreign and Domestic Commerce, Washington, D. C. On account of the disturbance with foreign commerce caused by submarine activities it is likely that the January record will remain unexcelled for some time.

In the four classes for which the quantities of electrical articles are reported, there were shipped in January the following: Electric fans, 2,874; arc lamps, 71; carbon-filament lamps, 107,401; metal-filament lamps, 891,387. The following table gives the detailed comparative figures:

Articles.	January, 1917.	January, 1916.
Batteries	$ 379,781	$ 115,354
Dynamos or generators	271,742	56,983
Fans	43,660	16,010
Insulated wire and cables	808,579	265,622
Interior wiring supplies, etc. (including fixtures)	133,140	87,611
Lamps—		
Arc	973	1,203
Carbon-filament	15,470	14,667
Metal-filament	181,785	109,720
Meters and other measuring instruments	94,575	75,352
Motors	659,620	389,380
Telegraph instruments (including wireless apparatus)	24,808	5,802
Telephones	132,807	69,050
Transformers	133,539	55,708
All other	2,032,445	1,058,360
Total	$4,912,924	$2,320,822

LARGE GENERATING STATION NEARS COMPLETION.

Third Largest Plant in New England Has Initial Capacity of 37,000 Kilowatts.

A new generating station of the New Bedford (Mass.) Gas & Edison Light Company is now under construction, at a cost of about $2,500,000. This is the third largest station in New England, being exceeded in capacity only by those at Boston and Providence. The immediate capacity is 37,000 kilowatts, there being three 4,000 kilowatt generators, one of 10,000 and one of 15,000 kilowatts. By vote of the directors, another 15,000-kilowatt unit will be added, to provide for the rapidly growing power load. This will involve the addition of 60 feet to one end of the station building.

The Stone & Webster Engineering Corporation is doing the work.

Group of Employees of Toledo Company Active in Formation of New Company Section.

Employees of the Toledo (O.) Railways & Light Company have recently formed a joint association made up of a local company section of the National Electric Light Association and a local section of the American Electric Railway Association. An interesting program for coming meetings has been arranged.

Miscellaneous NEWS NOTES

Novel Radio Installation.—An interesting aerial telegraph apparatus is in operation near Borden, Ind., owned and operated by R. M. Benton, district manager of the Central Radio Association. The aerials are suspended from a cable, which is strung from hilltop to hilltop, giving an elevation of 200 feet.

St. Louis Central-Station Company Files Rate-Reduction Schedule.—The Union Electric Light & Power Company, of St. Louis, has filed notice with the Missouri Public Service Commission of further reductions in electric rates. At present the maximum rate is 8 cents a kilowatt-hour and was adopted when the number of consumers reached 75,000. The new schedule provides for a maximum rate of 7.5 cents a kilowatt-hour when the company has 93,750 consumers, 7 cents when the number is 112,500, 6.5 cents when it is 131,250 and 6 cents when it is 150,000.

New Transmission System for Southern Power Company.—The Southern Power Company, of Charlotte, N. C., has awarded a contract to Milliken Brothers, 111 Broadway, New York City, for a total of 1,000 steel towers for its proposed transmission line from the new Wateree hydroelectric station on the Catawba River to Charlotte, an aggregate distance of about 40 miles, including extensions to other points on the high-tension system. This makes a total of approximately 6,300 towers which Milliken Brothers have supplied for the Southern Power system, or about 630 miles of line. The new towers will be 70 feet high and of similar type to those heretofore used, carrying lines at 110,000 volts.

Ohio State University Students on Inspection Trip.—Fourth year students in the departments of electrical and mechanical engineering at Ohio State University have during the current week been on an extensive inspection trip, the itinerary of which included stops at Pittsburgh, Buffalo and Cleveland. Among the plants visited were those of the Westinghouse Electric & Manufacturing Company, Niagara Falls Power Company, Hydraulic Power Company, Burke Electric Company, Erie Works of General Electric Company, Electric Controller & Manufacturing Company, National Lamp Works of General Electric Company, Lincoln Electric Company and American Works of American Steel & Wire Company.

Urges Conservation of Water Powers.—At a meeting of engineering students at Portland, Me., March 29, Professor C. M. Spofford, of the Massachusetts Institute of Technology, Boston, said that one Maine river would, if fully developed, provide as much power as is used in the cotton mills of Falls River, New Bedford, Laurence and Lowell, Mass. At present, he pointed out, only about one-sixth of the available energy is developed. There are five other Maine rivers besides the Kennebec, which are capable of producing vast amounts of electrical energy, and which are as yet only partially developed. Professor Spofford said the great manufacturing centers in the East rely mostly on steam.

Report on Causes of Poor Illumination.—Factors largely responsible for poor illumination are small, narrow windows, low power artificial lights placed too far from the point of operation, and neglect of facilities at hand for obtaining light, according to a report of the Pennsylvania Department of Labor and Industry. By this neglect is meant lack of cleanliness. There is scarcely a single industrial locality which does not contain several buildings which are built with a supply of window space sufficent to illuminate amply the interior. The dust and dirt accumulated upon them, however, destroy in large proportion their usefulness. The same condition is found in artificial lighting. The electric lamp bulb, dusty or streaked with dirt, often shaded with a fixture meant to be a reflector, but which in reality is anything but that, faintly illumines the work and impairs the health and the efficiency of the worker.

Commission Allows Stock Issue to Be Applied to Floating Debt.—The Massachusetts Gas and Electric Light Commission in 1913 approved an issue of 1,500 shares of new stock by the Amesbury Electric Light Company. Of the proceeds 600 shares were to be applied to cost of new generating equipment in contemplation. The company gave up the idea of enlarging its station and purchases power instead. Hence its officials applied for permission to devote the proceeds of the 600 shares to the payment of floating debt. This the commission grants, stipulating that the proceeds of the issue shall cancel notes outstanding January 1, 1917.

Important Meeting of Jovians to Be Held in Minneapolis.—An important meeting of the Minneapolis Jovian League will be held on the evening of April 12, at the Engineering Building, of the University of Minnesota. The program has been arranged so as to provide numerous educational features, matters of general interest and an elaborate entertainment. There will be several motion-picture films displayed, one entitled "King of the Railways," showing the means of transportation from the early days to the electrification of the Chicago, Milwaukee & St. Paul over the Rocky Mountains; another entitled "Speeding the Spoken Word," showing in detail how a telephone message is carried from New York to San Francisco, and numerous comic films. A local committee of prominent Jovians has been formulating plans for the improvement of the League during this year and these plans will be discussed at the meeting.

Paducah Municipal Plant Plan Not Approved.—Conversion of the existing city street lighting plant at Paducah, Ky., into a municipal light and power plant adequate to supply the needs of the city is of doubtful practicability, according to the report made to the City Commission by F. G. Proutt and A. L. Dabney, of Memphis, Tenn., engineers engaged by the city to make a survey of the situation and recommend action. According to the report complete equipment to serve the city would entail an expenditure of $183,955, the city plant would have to obtain at least half of the business of the community and an average rate of five cents per kilowatt-hour. To finance the proposed changes the commission recommended that a bond issue of $180,000 would be necessary. There was immediate opposition expressed by members of the commission, which insisted that the city was not in position to undertake to force the existing company out of business and that the only desirable and satisfactory plan for going into the business would be for the city to purchase the private plant.

Bill Providing for State Power Plant Introduced in New York.—Senator Graves, of Buffalo, has introduced a bill in the Senate creating the Niagara Hydroelectric Power Commission, which is to build, operate and maintain a state power house on the state reservation in Niagara Falls and to generate electricity and distribute it at cost to the communities of Western New York. The bill appropriates $650,000, of which not to exceed $275,000 is made available during 1917. The proposed commission under the provisions of this measure is to consist of three persons appointed by the Governor with consent of the Senate. The commission may take from the Niagara River 4,400 cubic feet of water per second, returning such water to the river at some convenient place. It may also take, with the consent of the majority of the City Council of Niagara Falls, whatever water diversion may belong to that city for sanitary purposes or uses and the electrical power developed therefrom shall be delivered to the city, provided it shall pay the cost of generation and transmission. A similar bill was introduced in the Assembly last year, but failed to pass.

Commercial Uses for Filtered Light

General Principles of and Technical Development in the Production of Light of a Particular Color Quality, Especially Daylight Value—Possibilities for Commercial Application of Filtered Light

By C. E. CLEWELL
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At our request Professor Clewell has summarized in this article some of the more interesting and important developments in the color modifications of modern illuminants, and in a subsequent article will point out some of the commercial applications of these recent developments. We believe that the average central-station salesman is only partially informed as to the possibilities of the variation of color values for different lighting installations, and that the information which has been gathered together in these articles will be of particular value in such cases.

THE TERM "filtered light" is used here in its popular sense as meaning the result obtained in the process of modifying certain color components of a lamp for the purpose, in some cases, of approximating the spectrum of daylight, as in the various artificial-daylight units, or for obtaining a color quality in the resulting light which differs in some respect from that of the light given off directly by the lamp.

It is the purpose in this article to review briefly some of the principal efforts which have been made along these lines up to date; and in a subsequent article to outline some of the general and special uses for such modifications in the color quality of the various modern illuminants, and to point out a number of the opportunities which are open to the central-station salesman by virtue of the presence of these devices in the modern lighting market.

Definitions.

In a recent issue of the *Stimulator*, published by the National Lamp Works of the General Electric Company, the situation in the lighting field due to these new units is summarized under the heading "Raw Light versus Filtered Light." This publication defines these two terms by stating that *raw* light means artificial light untreated as to color, and points out that there is a growing demand from such fields as those of textile mills, shop windows and department stores, paint factories, cigar stores, art studios and the like, for a light made more satisfactory by filtering. This is done by straining out undesired color components by passing the light through specially prepared filters, which often take the form of colored glasses, these glasses absorbing the objectionable or undesired components and thus modifying the spectral characteristics of the resulting light to some prescribed standard. This process is almost invariably accompanied by a decrease in the luminous efficiency of the lamp, or unit as a whole.

This popular term "filtered light" is used somewhat loosely in this article to include all the various methods of color modification, whether by screens, by tinted reflector surfaces, or by special lamps which are specially designed in themselves to give off directly light possessing specified color characteristics.

Illuminating Quality versus Efficiency.

It should be remembered that in practically all lighting work (and the particular phase under discussion is no exception), efficiency should be secondary to the accomplishment of the desired illumination results. Of course, in many cases effective results are obtainable with high efficiency, and this has been increasingly true as the electric lamps have been improved from year to year. Now, however, a somewhat different situation must be faced where the accomplishment of a certain quality effect in the resulting illumination calls for a very material sacrifice in the efficiency, which would be possible in the system were this one consideration of color eliminated from the situation.

In other words, the rapid and marked improvements, for example in incandescent lamps, during recent years, have generally been looked upon as increasing the possibilities for higher and higher values of effective lumens per watt in practical lighting installations, and the Mazda vacuum tungsten lamp in taking the place of the earlier carbon-filament lamps, and later the use of the Mazda C (gas-

Show Windows of a Chicago Store Lighted by Means of Mazda C-2 Lamps.

filled), instead of the Mazda vacuum units, were definite steps in this progress, first, more or less in making it attractive to lighting consumers to use more light for about the same cost and thus tending to remedy old inferior conditions, and second, with still further improvements on the lamps, it has been possible generally to reduce the energy used for lighting, and at the same time to maintain the same or even higher standards than those set by the earlier appearance of the Mazda vacuum units.

Utilizing the Advances in Lamp Manufacture.

All of these steps in the more recent history of electric illumination have been looked upon as advances in the art, in general, although the greater brilliancy of the Mazda C lamps and the tendency to use these lamps without suitable protection to reduce glare has, of course, been a very adverse condition in many cases. The lighting salesman has naturally used the advances in lamp ratings as a telling point in his sales work. The ability to furnish a lamp which will give more light for less money has been a logical point of advantage. However, the greater need for proper shading and diffusion of the Mazda C lamps has thus suffered, because to enclose such a lamp with a sufficiently dense diffusing bowl reduces the effective lumens per watt and tends to bring the illumination results back to those which were obtainable with the older Mazda B (vacuum) lamps when equipped with less dense diffusing glassware.

The use of diffusing bowls not sufficiently dense to reduce the glare to a reasonable degree with the latest Mazda C lamps has thus actually been advocated by certain central-station salesmen in response to the demands of customers for more light at a lower cost. The use of denser and hence more suitable diffusing bowls for the purpose of glare reduction is one of the ways in which it has been found very desirable to make a sacrifice in the efficiency of a lighting system for the accomplishment of greater excellence in the results. This sacrifice, however, although often appreciable, has naturally been accompanied by such an improvement in the comfort to the eyes of those using the light, that a lower intensity of the illumination is required under the improved conditions, this, in turn, tending still further to smooth out the differences between the energy required to light a given space with insufficiently versus adequately diffusing bowls.

Improved Illumination for Equal or Greater Energy Consumption.

The question of filtered light, however, opens up a somewhat different situation. In a general (not absolute) way the intensity of illumination required for a given use is about the same where moderate variations are made in the spectral character of the light. Hence, we may assume roughly that no particular gain is made by using a light filter in any reduction of the intensity required with the filtered light as compared with the unfiltered light. In other words, if we assume that the intensity required with the filtered light is about the same as is required with unfiltered light for the same use, then a cost comparison between filtered and unfiltered light may be based on the extra watts required with the filtered light to produce the same intensity as when unfiltered light is employed, together with additional investment charges made necessary by the new equipment.

It has been stated that to replace ordinary Mazda C lamps with artificial-daylight units, fifty per cent more watts are required for the same intensity in the two cases, due to the absorption of some of the light by the glass filter. If, on the other hand, filtered light from Mazda C lamps replaces a system of ordinary Mazda B lamps with an equal intensity, about the same wattage is required in the two cases. This means that if an ordinary system of Mazda B (vacuum) lamps has been in service for some time and then it is decided to install in its stead a system of artificial-daylight units equipped with Mazda C (gas-filled) lamps with the same intensity of illumination as before, there is no saving in energy consumption due to the use of the improved type of lamp, and the whole point of advantage in the use of the new system is one of improved illumination and its possible advantages to the conduct of the work performed or to the particular use for which it is selected.

A Sales Opportunity.

To the central-station salesman, therefore, the main point of appeal and the chief sales argument is not "Three times the original light for the same energy or cost;" nor even "Equal light for less energy;" but rather "Improved quality of illumination for the same (or even greater) energy consumption." It appears quite plainly that the last mentioned sales argument to be successful must greatly emphasize the advantages and importance of an improved quality of illumination, largely, if not entirely to the exclusion of any reference to changes in energy consumption or cost to the consumer. It is just here, then, that the central-station salesman may find one of his greatest opportunities.

Fig. 1.—Practical "Artificial Daylight" Unit Which is Made in Sizes Adapted to Mazda Lamps Up to 1000 Watts.

There is not so much credit due for a sale of one lamp in preference to another on a basis of its lower cost of operation. Every consumer wants to save money, and such an argument is probably, above all others, most convincing. There is, on the other hand, considerable credit due when a sale is made by convincing a consumer that it is to his material advantage to invest in new equipment at an equal or even a greater operating cost, for the purpose of gaining some improvement in the illumination effect from the new lighting equipment.

Some Uses for Filtered Light.

Before reviewing some of the methods employed for color modification, it is interesting to note that the uses of artificial-daylight units or treated glasses for producing some other change in the spectral composition of the resulting light, are finding an increasingly important place in a number of instances. The National Lamp Works reports that approximate-daylight conditions through the medium of artificial light sources are now to be found in many automobile display rooms for the purpose of enhancing the colors of various finishes; also in a number of high-class department stores; for use in cotton classification; for employment in certain offices and the like.

A very interesting statement is quoted in a recent issue of the National Lamp Works *Stimulator* as having been made by a customer in one of the large department stores in which approximate-daylight conditions are produced by the special light units, as follows: "I think all stores should be built like this *so that no lamps are necessary.*" If an impression of this kind can be given unconsciously to a patron by a lighting installation, there can hardly be a more genuine approval of its merits.

From the same source, we may further quote an opinion expressed by those using these artificial-daylight units in a large office building, as follows: "Upon entering, one gets the impression that natural daylight lights the room rather than artificial light. Every detail of the room and furnishings stand out in their natural color, and aside from the color-distinguishing values of the illumination, the eye is noticeably relieved from all strain even after working for hours under this light."

Special Developments.

The report of the Committee on Progress of the Illuminating Engineering Society for 1916, contains several references to this general field of color in artificial lighting. Under the head of Applications (page 10), it is pointed out that even in unfiltered form, the color of the gas-filled tungsten lamp has been found enough whiter than the vacuum tungsten lamp, to make possible its use in zinc refineries for distinguishing between dark zinc ore and lead. This is an interesting case of a requirement imposed on the illumination by the necessity of distinguishing between two colors or shades of metals.

From the same source (page 13) we find that improvements have recently been made in the method of feeding the gas into the Moore carbon-dioxide-tube lamp, this being of special interest because this type of lamp has been developed for use as an artificial-daylight unit, as described at some length below.

This report (page 48) also calls attention to data which have been published on the absorption spectrum of a series of the aniline colors for use in making color filters, which limit the transmission of light to a certain specified region of the spectrum; and reference (page 57) is made to the substitution of artificial light for natural light in a number of instances.

It will be seen from this brief outline of some of the efforts which are being made along these lines, that the strictly technical aspects of color modification involve many important problems, and it is hoped that the commercial lighting man may thus gain at least some idea of the amount of research and engineering work represented by a new unit, such as the so-called "artificial-daylight" lamp, and may thus be in a position to talk more convincingly to his customers of the illuminating advantages resulting from its use.

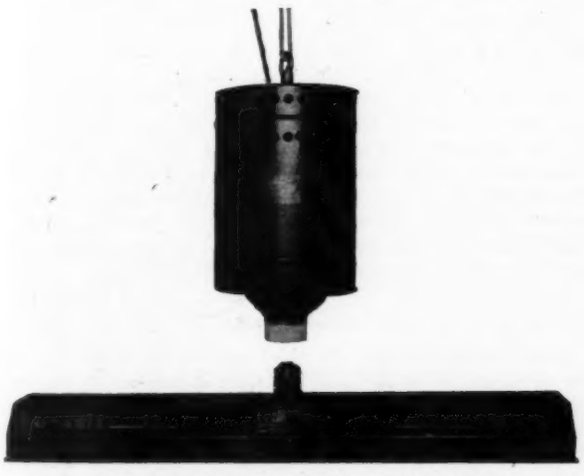


Fig. 2.—Moore Lamp for Color Matching.

It has been pointed out[1] that the use of a colored glass directly in the bulb of a lamp might appear at first thought to be the simplest solution of color modification. These authors point out, however, that the difficulties in the way of such a scheme make it appear that the most practical method is to use coloring material in the accessory rather than in the lamp bulb, and that the latter scheme still further commends itself when one considers that practically all modern lamps should, in any event,

Fig. 3.—Bottom View of Tube Element of Moore Lamp.

be equipped with shades or inclosing globes for the purpose of reducing the excessive brightness of the lamps. It is to be noted in this connection that colored-bulb lamps are on the market and in use to some extent, in spite of these difficulties.

Methods of Filtering.

In the following paragraphs, descriptive of methods for producing light of definite spectral characteristics, liberal references are made to the paper by Luckiesh and Cady, previously mentioned, and to a paper by D. McFarlan Moore on "Gaseous Conductor Lamps for Color Matching," *Transactions* of the Illuminating Engineering Society, Vol. XI, No. 2, page 192.

Tinting Reflector Surfaces.—The various experiments which have been made to produce light of an improved color value for the illumination of paintings and other colored objects have led, among other results, to the surface tinting of metal reflectors such as to alter the reflected light to a color complimentary to the direct light from the ordinary tungsten lamp used with the reflector. These results have not reproduced skylight or sunlight perfectly, but have been the means for increasing the blue and the blue-green rays to such an extent that these units have given satisfaction in such cases as in the illumination of mural paintings. Where the surface tint is very deep, there may be a loss of about 50 per cent in the original useful light.

Subtractive and Additive Methods.—Where a colored glass screen is placed between a lamp and the objects it is to light, as in Fig. 1, certain components in the color of the original light may be absorbed and the resulting light may be made to possess a modified spectrum due to the absorption of certain undersired components by this glass screen. This scheme for producing artificial daylight or light otherwise modified in color, is usually termed the *subtractive method,* in contrast to the so-called *additive method* where artificial daylight may be produced by the addition of two or more differently colored lamps, each possessing a spectral character (in the case of two lamps) so as to be complimentary to the other. For example, if the light of a mercury-vapor lamp be added to the proper proportion of light from a tungsten lamp, a white light may be obtained.

Another interesting case of the additive method is in the use of a fluorescent reflector with the mercury-vapor lamp. In this type of reflector the fluorescent property of the reflector surface adds certain red rays to the otherwise greenish light of the mercury arc, thus improving the color quality, with a material reduction in the luminous efficiency of the unit as a whole. The fluorescent reflector has a red colored reflecting surface and may be obtained on the market for use with the regular line of mercury-vapor lamps.

Gaseous-Conductor Lamps.—A color-matching lamp of considerable importance (see Fig. 2) is the so-called gaseous-conductor lamp due to D. McFarlan Moore. This lamp is sometimes termed simply the Moore lamp. In this unit the current is conducted through the tube by the gas which is contained in the tube. When this gas is carbon dioxide, the passage of the electric current through this gas produces a light which is well suited to color matching, and which resembles natural light

1 M. Luckiesh and F. E. Cady, "Artificial Daylight—Its Production and Use." Transactions Illuminating Engineering Society, Vol. IX, No. 8, page 861.

in its color characteristics. The Moore lamp, which in its earlier development was made in the form of very long glass tubes, is now available as a small, self-contained unit made up of two elements as shown in Fig. 2. The upper element is the transformer portion of the lamp and the lower element contains the lamp tube in its sheet-metal case.

The white light of the Moore carbon-dioxide vacuum-tube lamp, although a very good approximation to average daylight, and very satisfactory as a color-matching unit, has a somewhat low luminous efficiency, Moore giving a value of about 3 watts per candle as the specific consumption under certain circumstances. As stated at the outset, however, luminous efficiency is to a degree secondary to the accomplishment of desired illumination results, and this statement will certainly hold true in many cases where accurate color-matching ability is far more important than small differences in the luminous efficiency of two or more lamps which may be applied to the purpose. Fig. 3 is a view of a Moore tube and feeding scheme.

The Hussey Screen.—In addition to the methods of filtration described above, a screen was described by R. B. Hussey in 1912 for use with an intensified arc lamp, capable of producing a light approximately similar to sunlight in color quality. This screen was constructed of a checker-board arrangement of two differently colored glasses, the resulting illumination being suitably mixed by the addition of diffusing glass.

The work of Sharp and Millar on colored screens for use with tungsten lamps may also be mentioned among the efforts in this general direction, and the researches of Dr. Herbert E. Ives and others for producing color screens for this same purpose are well known in the lighting field.

Absorption Losses.

As pointed out earlier in this discussion, to obtain a color quality from tungsten lamps corresponding to natural light, either by the glass-screen method or by the tinted-reflector-surface method, means a fairly large loss of light by absorption. This fact is shown graphically in the curves of Fig. 4 where two curves (the lower ones) indicate the very large reduction in the spectral luminosity by absorption, and the upper curve indicates the conditions with the lamp unprovided with a glass screen.[2] While these losses may be overlooked where the advantages to be secured by the improved color quality are very noticeable, it is desirable, at least, to include a reference to the amount of such losses for the purpose of classifying the "artificial-daylight" lamp as to specific consumption along with the ordinary types of Mazda units.

The Mazda vacuum lamp, when rated at 1.25 watts per candle,

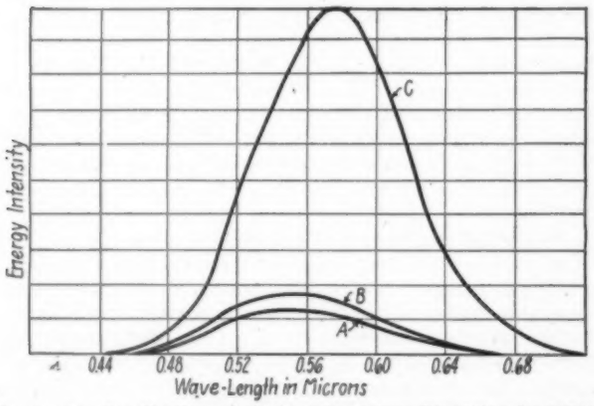


Fig. 4.—Luminosity Curves of Tungsten Lamp Operating Normally and as Daylight Lamps.

operates at about 7.9 lumens per watt, whereas the Mazda gas-filled lamp, when rated at about 0.45 watt per candle, operates at about 22 lumens per watt. Luckiesh and Cady give as values for the *transmitted lumens per watt* for the Mazda vacuum unit with the foregoing rating a range from 0.3 to 0.7 for skylight results of various qualities, and a range from 1.1 to 1.4 for sunlight results of various qualities. That is to say, where colored absorbing screens are employed with this type of lamp for producing a result approximating skylight, the lumens per watt of the original lamp amounting to about 7.9 is reduced to from 0.3 to 0.7 lumen per watt after passing through the absorbing screens of various qualities. This is obviously a very high absorption loss.

For Mazda gas-filled units with a rating of 22 lumens per watt, the *transmitted lumens per watt* after passing through the colored screens range in value from 2.9 to 4.2 for skylight qualities, and from 5.5 to 7.3 for sunlight qualities of the resulting illumination. These relations are indicated in the accompanying table as outlined by Luckiesh and Cady.

TABLE SHOWING THE EFFICIENCIES AT WHICH DAYLIGHT CAN BE PRODUCED.

Source of Light.	Character of Transmitted Light.	Transmitted Lumens per watt.
Vacuum tungsten lamp operating at 7.9 lumens per watt.	Accurate sunlight	1.1
	Approximate sunlight	1.4
	Accurate skylight	0.3
	Approximate skylight	0.7
Gas-filled tungsten lamp operating at 22 lumens per watt.	Accurate sunlight	5.5
	Approximate sunlight	7.3
	Accurate skylight	2.9
	Approximate skylight	4.2

In the paper by these authors, the following comment is found on the luminous efficiencies as just outlined and as given in the table. "It is here seen that artificial noon sunlight, or average daylight, as it has been called, can be produced by the new high-efficiency tungsten lamps at a luminous efficiency of from about 5 to 7 lumens per watt, or in other words at a luminous efficiency not much lower than that at which the older type of tungsten lamps operate. Skylight efficiencies are of course much lower. *It is thus seen to be practical to obtain daylight for general lighting by using a proper glass with the new tungsten lamps.*"

This last statement simply means that if general illumination has been looked upon as feasible with the vacuum tungsten lamps at the present time, then a substitution of gas-filled units (at least in the larger sizes) if used in conjunction with glass color screens, will also be feasible for general illumination. Whether or not an argument of this kind is to appeal to the consumer, will depend largely on whether his requirements for artificial daylight are great enough to warrant the investment for the new equipment. From the standpoint of the central station there is no question as to the acceptability of these new units with their higher specific consumption than ordinary units, and the advantages of encouraging their use are apparent, because such a course means a tendency to maintain the central-station load at the values set by the general use of the older vacuum Mazda lamps, and to minimize the tendency towards large reductions in energy consumed due to the substitution of gas-filled Mazda lamps for the older vacuum lamps.

Applications.

In the foregoing notes the chief purpose has been to review the developments in this field from the standpoint of the kinds of units now available; to describe some of their construction features; and to point out their relative efficiencies as producers of light. The central-station salesman, to take full advantage of the presence on the market of these newer lamps must logically first be posted on the kinds of units available and on their relative advantages.

In the subsequent article on this same general subject, it is planned to refer to one or more definite applications of these new lamps to actual cases; to refer to a number of special uses of glass screens in other lighting problems; and thus to tie up these notes on methods of producing artificial daylight to the methods followed in its practical uses.

2 These curves are taken from the work of Luckiesh and Cady previously referred to. Transactions, Illuminating Engineering Society, Vol. IX, No. 8, page 861.

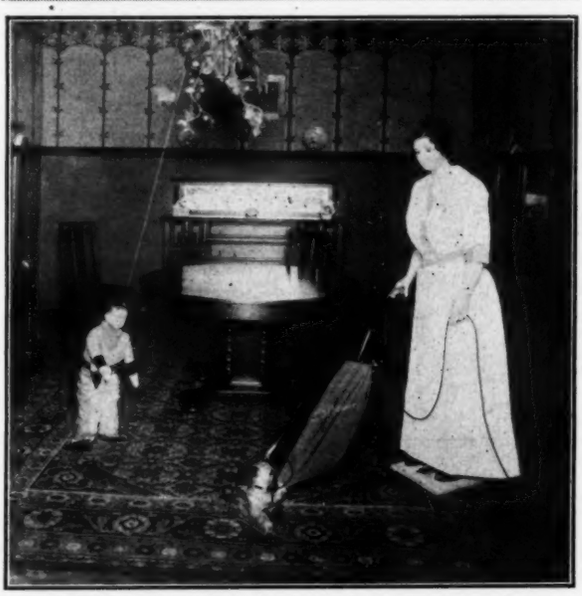
The Vacuum-Cleaner Opportunity

Both from the Merchandising Standpoint and as a Central-Station Load Builder the Vacuum Cleaner Offers Possibilities That Are Distinctly Worth While, Especially at This Season of the Year When the Sales Opportunities Are the Greatest

THE retailer of electrical appliances seems to be particularly fortunate. The widespread use of electricity not only provides devices that are in demand all the year 'round, but also provides articles that have a greater public appeal in each of the different seasons of the year, enabling the energetic dealer to concentrate his best selling efforts on some one device in each season. Just at this time it is vacuum cleaners.

Besides showers and "Wire-Your-Home" time, April brings house-cleaning time, clean-up weeks, before-moving activities and other evidences that we are breaking out of winter's shell and want things clean and bright. It is the vacuum - cleaner opportunity. We are in the midst of a season when this electric cleaning device has its greatest application and its work is appreciated the most. The thing for the retailer to do is to take advantage of the possibilities offered for building up sales.

Not so many years ago the vacuum cleaner was generally regarded as an extravagance—useful and efficient, of course, but just a bit too costly for the average householder. Improvement and simplification of design and reductions in manufacturing costs, together with a greater realization by the public of its utility, have caused the vacuum cleaner to become known as a comparatively inexpensive convenience and luxury that is enjoyed in many homes. The field for sale has been greatly widened, and right now, during the cleaning season, is the time to reach out for the laggards who need vacuum cleaners, can afford them and should be convinced of the fact.



The Window Display a Valuable Aid in Producing Sales.

The portable electric vacuum cleaner lends itself readily to exhibition and demonstration. An assortment of cleaners, with appropriate window cards and neatly arranged background forms a good display but does not have the life or appeal of a moving display. A demonstrator in the window will draw the largest crowds and produce greater sales. In the display shown motion was secured by means of mechanical figures and caused exceptional comment and sales.

Electric Cleaner a Good Sales Item.

If there was anything exceedingly difficult about selling electric cleaners such statements would be flighty, but the fact is the device recommends itself as a clean-cut, straight-away sales item with no drawbacks. Selling talks do not have to be doctored up or highly colored, for the device is always ready, by its performance, to clinch the arguments for its utility and convenience. Manufacturers have reduced production costs so that prices are attractive to the great middle class, and very substantial profits are left for the dealer. To sum it up: it would be a pity to have to urge the dealer to sell the vacuum cleaner; there is too much in its favor as a good sales item.

From the central-station standpoint the electric cleaner is regarded as one of the many devices that help materially in increasing the domestic appliance load. The newer types, easy to operate, are coming to be used daily instead of weekly, and the load, though small, is off-peak and not to be despised. Every machine in service is a source of income for the central station, and is reason enough for the interest in increasing sales.

That April is the month for vacuum cleaner sales and campaigns is too obvious to excite much comment. It's certainly a case of "making hay while the sun shines;" taking advantage of the selling opportunity and the need for outlining plans for some sort of intensified merchandising or campaign cannot be emphasized too strongly.

House-cleaning time is the very season that affords opportunities to play up vacuum cleaners in their greatest utility and get enthusiastic about it. It's just the time for the demonstrator to drive home his selling arguments—to show by actual work that it is the device for taking much of the drudgery out of housework, to lessen the disorder caused by house cleaning and make it less dreaded. It's the time to close up old prospects and make new ones and then close them up.

It cannot be said that vacuum-cleaner sales resemble spring colds—there is no epidemic of them. Merchandising is necessary. Correlated efforts are the most successful because the merchandising simmers down to a combination of educational and sales efforts. Big sales result from the tieing together of newspaper advertisements and street-car cards, circulars, motion-picture films, show windows and demonstrations in the store and the homes. If the dealer uses these sales factors to any great extent he will find himself with a vacuum-cleaner campaign on his hands—one worth cultivating still further.

Essentials of a Vacuum-Cleaner Campaign.

There are wide differences of opinion about conducting a campaign. Some merchandisers don't believe in them at all. But it is generally conceded that they produce good results and that is enough to recommend them. No set method can succeed everywhere, because conditions are different in many localities. Experience, however, has proved the following points about a campaign.

Store preparations, such as window displays, demonstrating facilities, instructions to salesmen regarding the construction of different makes and sales talks, are necessary. First announcements are made by advertisements in newspapers or other mediums and these followed up during the campaign. Central stations make announcements with the monthly bills.

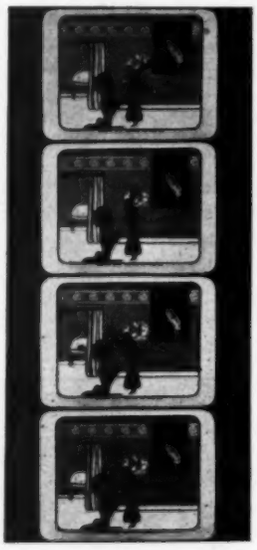
A prospect list is usually necessary for solicitation. This can readily be made up from lists kept by some dealers and central stations. If no list is available, the names may be weeded out of the telephone directory. Then a signed personal letter, with good selling arguments, is sent to those on the list, together with a return card to be mailed back if the recipient is interested. This method brings returns of one to 10 per cent—enough for the solicitors to get started on. Besides it serves as a good announcement of the store's activities, and will bring some customers to the store. With the outside salesmen started they can increase the number of prospects by making inquiries at the homes when demonstrations are given. After a sale is made prompt delivery is very desirable and is appreciated. It is a good plan to be sure the customer fully knows how to use the device, and it creates an effective impression to make personal calls or telephone calls for this purpose. Keeping a customer satisfied makes another salesman.

These plans and their variations have been tried again and again, and the results have not been so much a measure of the success of the plans as they have been of the enthusiasm of the organization using them. Concrete suggestions gained from successful campaigns serve to show the road to the retailer who contemplates taking advantage of the opportunity the season affords.

Suggestions from Successful Campaigns.

While a vacuum-cleaner campaign must, in the final analysis, be planned with particular reference to local conditions, there are many invaluable suggestions that can be gleaned from a perusal of a few of the more noteworthy efforts that have demonstrated their merit. In Chicago, for instance, a campaign conducted last year demonstrated that a crew of men working together under a manager obtained much better results than when individual salesmen were assigned to separate territories.

The crew idea was considered to be better than the individual-man scheme, because loafers, if any, could thus be weeded out of a crew in two or three days, while with the other plan it is generally necessary to give each man at least two weeks to prove his worth. It was the aim of the Commonwealth Edison Company in this campaign to cover the entire residential section of the city, excepting those exclusive homes in which salesmen probably could not secure an audience with the lady of the house. Apartment dwellers and moderately well-to-do home owners were considered the best prospects.



Motion Pictures to

Motion-picture films can be made the most important publicity feature, as in the Kansas City Light & Power Company's campaign. Five different films were prepared, the scenarios being composed by representatives of the film companies, the publicity department of the light company, and men and women in the lighting sales department. One of the pictures showed a procession of animated brooms, the terrific dustcloud, and a housewife throwing up her hands, exclaiming that she is tired of it and wants a vacuum cleaner; a vacuum cleaner enters, and cleans a room without dust. Another picture showed a man sweeping, a woman standing by holding a club over his head, saying, "I've endured this drudgery long enough;" he hastily brings her a vacuum sweeper. In each of the pictures, the slogan, "It Will Help Mother," was the closing feature of the film.

Twenty-five motion-picture houses were used. Five of these

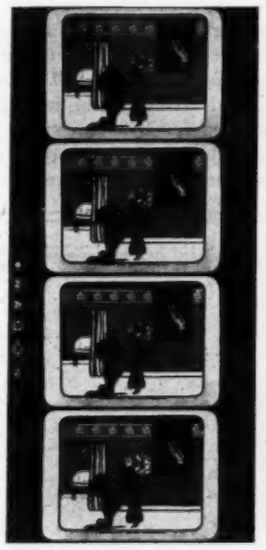
Although the men employed were all experienced salesmen, a factory man was called in before the campaign was started to give a demonstration before the group and to show how the cleaner was made. It was also decided in the beginning to adopt the "first-payment" plan rather than the ten-day free-trial plan, because women who have no intention of purchasing will accept a cleaner on ten days' free trial, clean the entire house with it and return it at the end of the trial period. When, however, the women are asked, as they were in this campaign, to pay

The Newspaper Advertisement Does Its Full Share in a Vacuum-Cleaner Campaign.

For making announcements and creating public interest in a campaign the local newspapers are excellent mediums. This fact has been proven by many dealers and central-station companies in their merchandising activities. Good illustrations, together with catchy headlines bringing out the utility of the electric cleaner, and well-worded copy stating terms and suggesting buying action, succeed in giving an impetus to a sales campaign. Manufacturers' newspaper advertising helps can be used to good advantage in preparing attention-getting and sales-producing copy. The amount of space and the number of insertions of advertisements is at the discretion of the dealer.

$2.50, or ten per cent of the purchase price, in cash, and the balance in 11 monthly installments with electric light bills, they regard the transaction as a concluded sale when part of the money is paid. There are no comebacks. Few women will pay $2.50 to have their homes cleaned once or twice. The company's arrangement with the salesmen was that they were to be paid on a commission basis, receiving $2.50 for each cleaner sold.

Advertise Cleaners



were downtown, the largest and best houses in the city. The five pictures were shown at these houses near the beginning of the campaign, and again at its close. The business-district shows are repeated 11 times a day.

In the suburban theaters, each house had the films one week. Every Saturday evening the films were changed to other theaters, the week's display having given all the picture patrons of the particular communities an opportunity to see the films. The light company selected the theaters and planned the booking.

The large number of telephone inquiries received Monday mornings were directly traceable to the motion-picture advertising; most of them came from the districts where the advertising films had been seen for the first time on Saturday night or Sunday, in the community theaters. Each of the five films was 30 to 50 feet. The cost was $3 per foot per week, including manufacture and exhibition.

The keynote of the campaign was education. After gaining an entrance to each house the salesman asked permission to show what a cleaner will do, and offered to clean any rug or carpet in the house without charge or obligation. To make the demonstration effective he showed the interior of the bag before and after demonstration. After that his selling argument began. When a salesman found the prospective customer not at home he left a postal card telling of the call and offering to come again and demonstrate the cleaner if the card was filled out and returned to the company. Very few of these cards were returned. On other occasions, when salesmen were unable to complete sales, but believed the people on whom they had called to be prospects, letters were written from the office to follow up the salesmen's effort, and a return card was inclosed. About five per cent of these cards were returned, and in no case did the salesmen who followed up such requests fail to effect a sale. The difference between the success with the latter type of cards and those mentioned before can be definitely attributed to the fact that the recipient of the latter type had in each case been educated to the advantages of the electric vacuum cleaner, whereas those who received the former cards had not seen a demonstration.

The big results of the campaign did not come from the direct sales made by the crew. They were considered the field missionaries. The company's electric shops, however, were the places which cashed in on the field salesmen's efforts, and the campaign was a marked success.

Campaign at Kansas City.

One of the most comprehensive and successful vacuum-cleaner campaigns on record was that conducted last year by the Kansas City (Mo.) Light & Power Company, during which 1,500 cleaners were sold.

Twelve hundred electric carpet sweepers and 300 vacuum cleaners were sold in six weeks. The former were regularly on sale previous to the campaign at $19.75; the sale price was $15. There was no reduction on the vacuum cleaners, which went at the usual price of $50 and $60. The company received no payment on delivery, and gave the customer six months in which to pay.

The advertising for the campaign was very carefully planned, and quite as carefully was the work of solicitors planned to get the maximum value from the advertising. The advertising was of five kinds—window display, motion pictures, street-car cards, newspaper space and monthly bills.

The company had planned to make its drive on vacuum cleaners coincident with the usual spring clean-up in Kansas City, which is set for sometime in April, and is preceded by several weeks of agitation by the city health department and various civic organizations. Ordinarily this city campaign makes its first appearance about March 1, and plans were therefore made to start the advertising at that time. On the February bills sent to customers, were printed advertising coupons bearing the offer of the cleaner

A Clean House
Electric Vacuum Cleaner
Commonwealth Edison Company
Enjoy this Electric Cleaner in your home
Everything Stays Clean
RUGS and portieres, upholstery and bedding, walls and floors—everything about the home stays clean and dust-free, with the use of Electric Cleaner, at the cost of but a few cents per week. Let us tell you more about it.
ELECTRIC CLEANER
ELECTRIC SHOP
It requires only one-fourth the effort to clean house with
THE HOOVER
SUCTION SWEEPER
Long-armed attachments reach everywhere. (See illustrations.) No stepladder climbing. No stooping. No stretching. No "raising the dust." Powerful suction draws off the dust and cob-webs on moldings, curtain tops, behind pictures, around books, in overstuffed furniture and mattresses, under beds, radiators, tables, dressers, etc. No need to unpack or remove curtains. Guide the cleaner lightly over the surface to be cleaned and the dirt disappears.
TO GET
This Electric Vacuum Cleaner
For $15 at Special Sale
You Must Call the Kansas City Light & Power Co.'s NEW Telephone
BELL, GRAND 50 HOME, MAIN 50
This price will not long be maintained. Order NOW if you want one
Nothing Down
Six Months to Pay!
Free demonstration in your own home. No dust, no dirt, no turn up home if you use an
ELECTRIC VACUUM CLEANER
THE ELECTRIC SHOP
1500 Grand Avenue
$3.75 will place this Electric Cleaner in your home
A Remarkable Opportunity to Secure a Good Electric Vacuum Cleaner
In order to dispose quickly of a limited number of high quality Electric Vacuum Cleaners, we are offering them at $13
Order Today—Don't Wait
ELECTRIC SHOP—CHICAGO
72 West Adams St., Cor. Clark
Michigan and Jackson Blvds.
Clean House the Easy Electric Way
It's just like magic the way dust disappears when an Electric Vacuum Cleaner is used. In fact the
Electric Vacuum Cleaner
here pictured, with its many improvements in design and construction, makes Fall House-cleaning easy.
Demonstrated Free
ELECTRIC SHOP

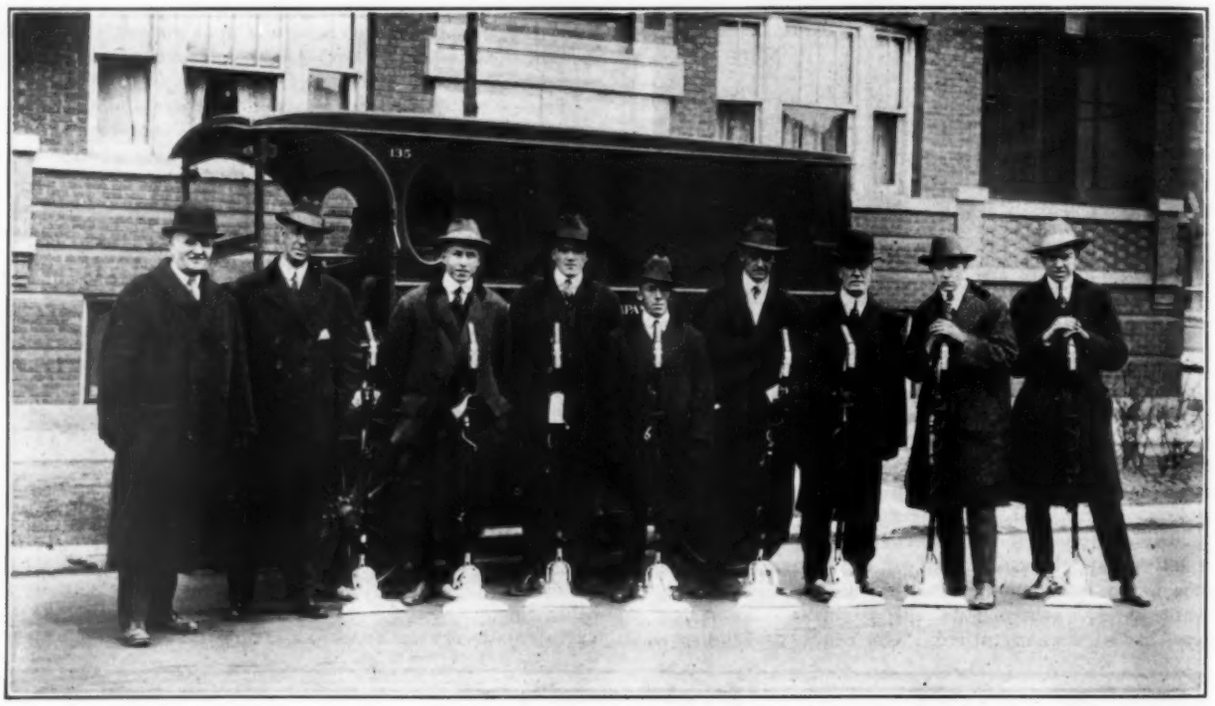
Advertisements That Have Produced Good Publicity and Induced Vacuum-Cleaner Sales.

at $15, and they went into the hands of customers on March 1. A few orders came in. The real campaign, however, began March 15. The bill-coupons have always been considered valuable advertising for every customer has to see what they say, as he tears them from the bill, or glances at the statement to observe the charge.

On these coupons appeared for the first time the "slogan" of the campaign, "It Will Help Mother." And it was used on every bit of advertising, often being repeated one or more times, for emphasis.

The show window of the Electric Shop was used during the entire period for the display of sweepers and cleaners, the display being changed three times, and the window in two cases containing other devices also.

Advertising cards were placed in the street cars March 15, bearing the offer of the sweeper for $15. For two weeks previous, however, "teaser" advertisements had been



The Sales Crew Is An Effective Means of Introducing the Vacuum Cleaner.

Demonstration is the best way of educating the public to the use and convenience of the electric cleaner, and the outside salesman gets many opportunities to show people who are not interested enough to go to a store for that purpose. The solicitor speeds up buying action and contributes greatly to the success of a campaign.

run on these cards. The first ones bore only the words "It Will Help Mother." Then cards appeared with the added phrase, "It's a vacuum cleaner at $15."

Newspapers were used only on Sundays. The three Kansas City newspapers had half-page advertisements on three Sundays. The largest response, in inquiries, came on Mondays following the appearance of the newspaper advertising and this factor shares with the motion pictures the credit for the larger Monday sales.

A sales force of five men was assigned to the electric carpet sweeper and vacuum cleaner campaign, young men taken from the lighting sales department, but without special experience with the cleaners. They had, however, been given a short course in demonstrating the devices, and had been coached in sales talks. These young men made a house-to-house canvass, always in the communities where the advertising films were being shown. On Mondays the salesmen transferred their activities to the district to which the films had been transferred, adjusting their work as the campaign progressed. For instance, only two suburban theaters had the films the first week; all five worked in those two districts. The next week, three suburban theaters had the films, and three of the men went to those districts, while two remained in the first communities where the films had been shown. The salesmen did not carry cleaners with them; and this was considered an important point. They could not gain audience, much less entrance into the houses, with cleaners in their hands. They merely sought prospects, asking for the opportunity of demonstrating the cleaners. During the first few days of the campaign, the men made definite effort to work for a continuous period soliciting. But soon it became impossible—and unnecessary—to set aside any time for this detail. The requests for demonstrations were secured while going from one demonstration to another. Frequently enough such requests were obtained from neighbors during demonstrations, to fill the next day. The men were able to make about 10 demonstrations a day, and the estimated time spent in seeking prospects was an hour a day. The chief handicap in piling up sales was in the time lost between demonstrations.

The average of prospects solicited who asked for demonstrations was nearly 30 per cent.

The telephone calls into the office, asking for demonstrations, kept three women from the Electric Shop "on the jump." These calls were a difficult matter to handle, because they came from widely scattered districts of the city. Some were from districts five miles and more from the central office, and two or three miles from a motion-picture show, but in most cases the prospects had seen the films somewhere. Other calls were from the districts of the films, but many blocks from the sections being worked by the salesmen.

While the selling effort was concentrated on the cleaner at the bargain price of $15, nearly 25 per cent of the demonstrations resulted finally in the sale of a more expensive machine. The request for information on the higher-priced cleaners was always spontaneous—but was of course met promptly by the salesmen and salesladies.

Fighting Dust by Vacuum Cleaning

Promotion of Health Through Sanitary and Effective Cleaning—Dangers of Dust and Old-Fashioned Attempts at Its Removal—Advantages of Electric Vacuum Cleaning Systems

PROGRESS in the household arts is now almost as rapid as in the industrial arts. Although long and correctly regarded as ultra-conservative, the housewife is showing an encouraging tendency to use more efficient, scientific and otherwise improved methods of housekeeping. She is manifesting a willingness to learn and will readily adopt anything that makes for a higher standard of living.

The steadily increasing use of electricity in the home is an excellent example of this progressive tendency in domestic economy. Electric lighting, electric laundering and pressing, light cooking by electricity, and other simple electrical applications have required merely demonstration to convince the housewife of their superiority. Complete cooking by electricity, electric dishwashing and electric vacuum cleaning are now making rapid strides wherever educational work has been undertaken to show clearly their many advantages. This article on vacuum cleaning will therefore first take up the educational aspects of the problem of sanitary housecleaning.

THE DANGERS OF DUST.

We may carp and cavil at sanitary preachments if we will, but we ignore them at our peril. Rich or poor, high or low, all are alike liable to become the victims of such diseases as are spread in the floating dust of ill-kept towns and dust-ridden houses.—From "Dust and Its Dangers," by Dr. T. M. Prudden.

This striking quotation touches the keynote of the educational propaganda necessary to arouse housewives and building owners to the imperative need of dust-free homes and places of employment, which means using the only sanitary and effective means of dust removal—vacuum cleaning.

Importance of Cleanliness to Health.

To attempt to emphasize the importance of cleanliness at first seems like insulting the housewife, because cleaning and cleanliness are hers by second nature. The old saying that cleanliness is next to godliness has been instinctively accepted by the housekeeper without fully comprehending, however, all of the vital elements that cleanliness includes. To a great many, beauty or even merely "looks" constitutes the prime need for cleanliness, as is evidenced by the feverish cleaning generally done when company is expected. Sociologists tell us that cleanliness has a marked moral value. But aside from the esthetic, ethical and other values of cleanliness, it possesses one of fundamental importance—health.

Good health has rightly been said to be the greatest asset one may possess, for without it no other treasures can bring satisfactory enjoyment. When we stop to consider that in our climate during the greater part of the year most persons spend one-half or more of each day in the home, the importance of healthful conditions in the home begins to dawn on us. It is during these winter months of confinement that conditions in schools, factories, offices, theaters, etc., are least sanitary and most favorable for the spread of disease. This makes it all the more desirable, in fact imperative, to make living conditions in the home as wholesome as possible so that on returning from the occupations of the day one may thoroughly recuperate and restore the resistance of the body to its maximum.

These simple facts have been emphasized from time to time by public health authorities who are leaving no stone unturned to arouse the public to adopt means for preventing disease instead of first contracting and then fighting it. Of the various safeguards strongly advocated, such as pure air, wholesome food, proper rest and sanitary cleanliness, the latter is probably the most important. It has long been known that epidemics of the most virulent diseases have spread most rapidly and been most fatal in places where filth abounds. The same is true of practically all infectious diseases, even the relatively mild ones, such as common "colds." The exact reason for this was a mystery until the development of the new science of bacteriology, which has discovered and studied the particular germs whose introduction into the system of a susceptible person brings on an attack of the corresponding contagious disease. A distinguishing characteristic of most of these pathogenic or disease-producing bacteria is that they thrive on and cling to practically all kinds of dirt, especially decaying animal and vegetable matter, which in small particles forms a large constituent of the ordinary dust of homes, shops, streets, etc.

Dust—Where It Comes From and Where It Accumulates.

After completing a strenuous sweeping and dusting, the housewife is often amazed to find that a new crop of dust has appeared. While this is partly due to the ineffective methods of dust removal used, dust is bound to reappear. Even in rooms that have been carefully cleaned and aired and then tightly closed for a long time considerable dust is found. In fact there are many sources of dust not generally known.

It enters largely from outside, being blown in by winds through open or leaky windows and doors; this may be street dust, soot from smoky chimneys, dust from roofs, etc. It is brought in as mud and dust on shoes and clothing; some of the most dangerous house dust comes from dried sputum brought in on shoes.

Considerable dust and dirt is formed within the house from wear and tear of floors, carpets, furniture, etc.; from table and kitchen crumbs and refuse; from ashes, coal dust, etc., where grate fires or stoves are used; from tobacco ashes, matches and other discards; from wear of mattresses, pillows and other bedding; bits of paper, packing material, hair, lint, threads etc.

The finer the particles of dust the more completely they are disseminated throughout the room whenever stirred up so as to lodge on even the highest surfaces. The heavier particles remain on or settle down to the floor, where they are pulverized and trodden into carpets and rugs and into the crevices of bare floors. Consequently the floors and their coverings tend to accumulate the most dust, except for the fact that they and other surfaces on which the dust is actually seen receive most of the cleaning. The fact is, however, that on such inaccessible and unseen surfaces as the tops of doors and of window and door frames, picture moldings, behind pianos, bookcases and other heavy furniture, etc., the dust is seldom disturbed and accumulates till the annual or other complete housecleaning. Even what cleaning is given to textile floor coverings by the older methods is very seldom thorough, so that from the sanitary standpoint they should be tabooed, as is done in hospitals. The dictates of fashion and comfort, however, demand the use of rugs and carpets, so that their cleaning constitutes the most serious problem of housecleaning. Before taking this

up it is desirable to consider the constant danger in dust.

The Constant Menace in Dust.

What has been said before and particularly the quotation from Dr. Prudden's book should have indicated what the greatest danger in dust actually is. Of course, everyone knows that dust is a nuisance and source of discomfort, but the deadly danger that all too frequently is lurking among even its relatively inoffensive particles is seldom fully realized. Few people appreciate that on a particle of dust there may be myriads of active or dormant bacteria of tuberculosis, pneumonia, bronchitis, laryngitis, diphtheria, or the many other varieties of virulent or mild diseases of the respiratory organs. No matter whether these germs were set free by sneezing, coughing or expectoration, they are and will be found in dust as long as victims of these diseases do not safeguard themselves against scattering the microbes far and wide. Modern medical science has conclusively proven that respiratory diseases are spread in this manner. It must be remembered that these disease bacteria are of infinitesimal size and may float in the air on dust for a long time. It is not necessary to refer to the presence in dust of the bacteria of other dangerous diseases, since those already mentioned cause enough trouble and misery to serve as a warning against the dangers of dust.

It is true that the body has certain defenses against dust infections. Most of the dust is or should be caught on the moist inner surfaces of the nose or upper throat. That which passes these barriers is caught either in the trachea and bronchial tubes of the lungs, or finally on the fine hair-like cilia that line even the smallest air cells. Other safeguards, such as special secretions and defense cells are provided to protect the very delicate tissues of the lungs so that in the normal condition of the body dust does not remain within the lungs.

In any weakened condition, however, these defenses or resistances are not always effective to ward off irritation followed by infection from dangerous dust. Space does not permit discussing these intensely interesting defensive processes in detail; any good medical book on the respiratory system may be consulted for particulars. It should be stated, however, that constant breathing of air laden with even harmless dust imposes too great a task on the dust-rejecting processes, so that the respiratory passages become permanently coated with a scum of dirt that is a most fertile breeding ground for malignant bacteria.

Dust in the home does not receive to any extent the oxidizing and germicidal action of sunlight and fresh, pure air, so that indoor dust is apt to be more dangerous than that outdoors. Moreover, the dry and overheated air commonly found in modern houses and apartments in winter leaves the nasal and other respiratory passages in very poor condition to ward off infection.

Fallacy of Old-Fashioned Attempts at Dust Removal.

The old-fashioned but conscientious housewife was an energetic wielder of the broom in her persistent fight on dust and dirt. Serious straining of the arms and back was accepted as a necessary accompaniment of the principal known method of removing dust. But the fact was not universally recognized that sweeping removed the dust from floors or carpets only to scatter a very great part of it throughout the room or through the open windows into the premises of neighbors.

OLD AND ABSURD DUSTING METHODS.

In the past, the broom, dusting brush, and cloth have been in daily use in stirring up this dust, and collecting as much as possible of it in the dust-pan. Instead of really collecting the dust and getting rid of it, only a very small percentage is collected; the rest has simply been stirred into the air and transferred from one place to another. During the process of settling (which really takes several hours), one has to breathe air which is heavily laden with dust and other impurities. * * * * All this is now altered, thanks to the electric suction cleaner.—From "Electric Cooking, Heating and Cleaning," by Mrs. Maud Lancaster.

The adjoining quotation from Mrs. Lancaster, a well known authority on modern housekeeping, gives a candid opinion on old-fashioned sweeping and dusting. The tiresome and exhausting nature of this work is well known. After a day's cleaning of this kind the housewife has seldom energy left for any other of her many tasks. Moreover, the moving about and lifting of furniture required for proper sweeping, and the stretching to reach high places that will be indulged in by a conscientious housekeeper is likely to bring on serious bodily derangements.

In spite of all the laborious efforts put forth, this process of cleaning is entirely ineffective. In the case of carpets and rugs, the action of the broom or brush drives considerable dirt down deep into the nap of the material. After completing what to the eye may seem to be a thorough cleaning, great quantities of dirt can easily be extracted from carpets by any good vacuum cleaner. As to the dust that has been stirred up into the air, Dr. Prudden reports some interesting tests in New York City. In the case of a carpeted room 75 bacteria and one mold settled on a bacterial test plate during five minutes while the air was still just before sweeping. Immediately after sweeping and when the air was again seemingly still, a similar test showed 2,700 bacteria and 6 molds, or 36 times as many germs due to the scattering of the dust by sweeping.

Another old-fashioned method of carpet cleaning is shaking and beating outdoors. If done thoroughly, especially beating, the rugs and carpets may be cleaned more effectively than merely by sweeping in place. However, there are so many serious objections to this practice that it should no longer be countenanced. Many cities already have passed ordinances to prohibit it, since no one has the right to scatter his dust and dirt into the premises of his neighbors. Beating and shaking of rugs is extremely destructive to even the strongest of them and certain kinds quickly go to pieces under this treatment. This process also requires much strength, if done properly, much more than is possessed by the average woman. Little need be said of the filthy and insanitary nature of such work.

Let us now consider the mechanical carpet sweeper. This was developed about 1880 and afforded some improvement over wielding of the broom and brush. However, both from the standpoints of effective and sanitary cleaning the carpet sweeper has most decided shortcomings. It does not clean as effectively as a good broom because its revolving brushes merely pick up the visible surface dirt and scarcely touch that within the nap. What it accomplishes is to save use of the dust pan. It still scatters into the air a great deal of the finer dust particles.

Electric Vacuum Cleaning.

The first vacuum cleaner was built by D. T. Kenney in 1902. Since then this industry has made wonderful strides, as is shown by the illustrations of present-day cleaners on pages 591 to 597. Aside from a few hand-operated machines, which are tiresome and not effective, and an occasional engine-driven stationary plant, vacuum cleaners are invariably motor-driven because of the many well known advantages of electric drive. The electric motor has made the portable vacuum cleaner possible and has greatly extended the use of stationary cleaners. Even the least powerful portable electric cleaner so vastly superior in sanitary action, comfort and convenience in use to the old-fashioned methods that this article has been confined to emphasizing the defects of the latter.

Possibilities of the Electric Furnace

A Comprehensive Discussion of the Advantages of Electric Furnaces, Their Installation and Operation, Showing the Desirability of This Load from the Central-Station Standpoint

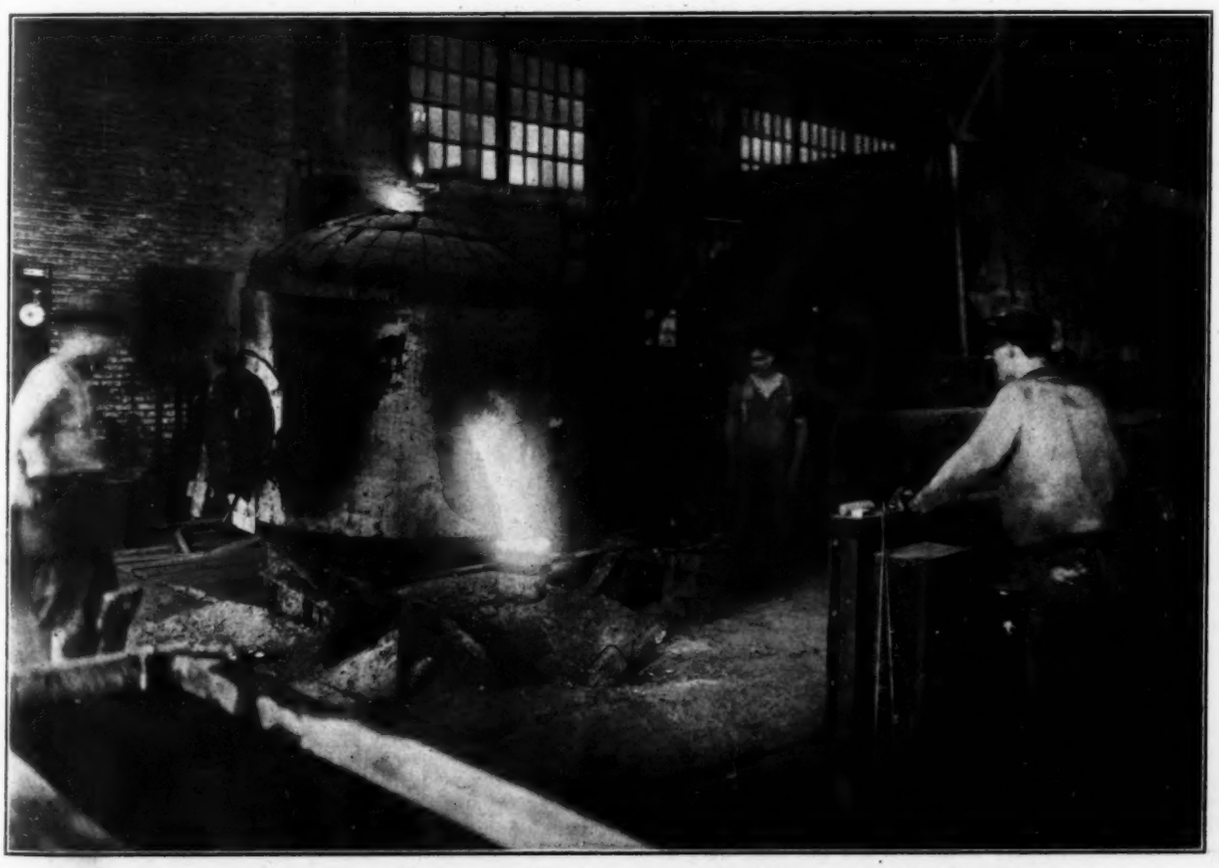
By THOMAS R. HAY
Duquesne Light Company, Pittsburgh

This is the concluding installment of a series of two articles dealing with the electric furnace from the central-station standpoint. Special reference is made to the class of rates which must be made to secure this business. The first article, which appeared in the last issue, discussed the installation and operating characteristics of electric furnaces.

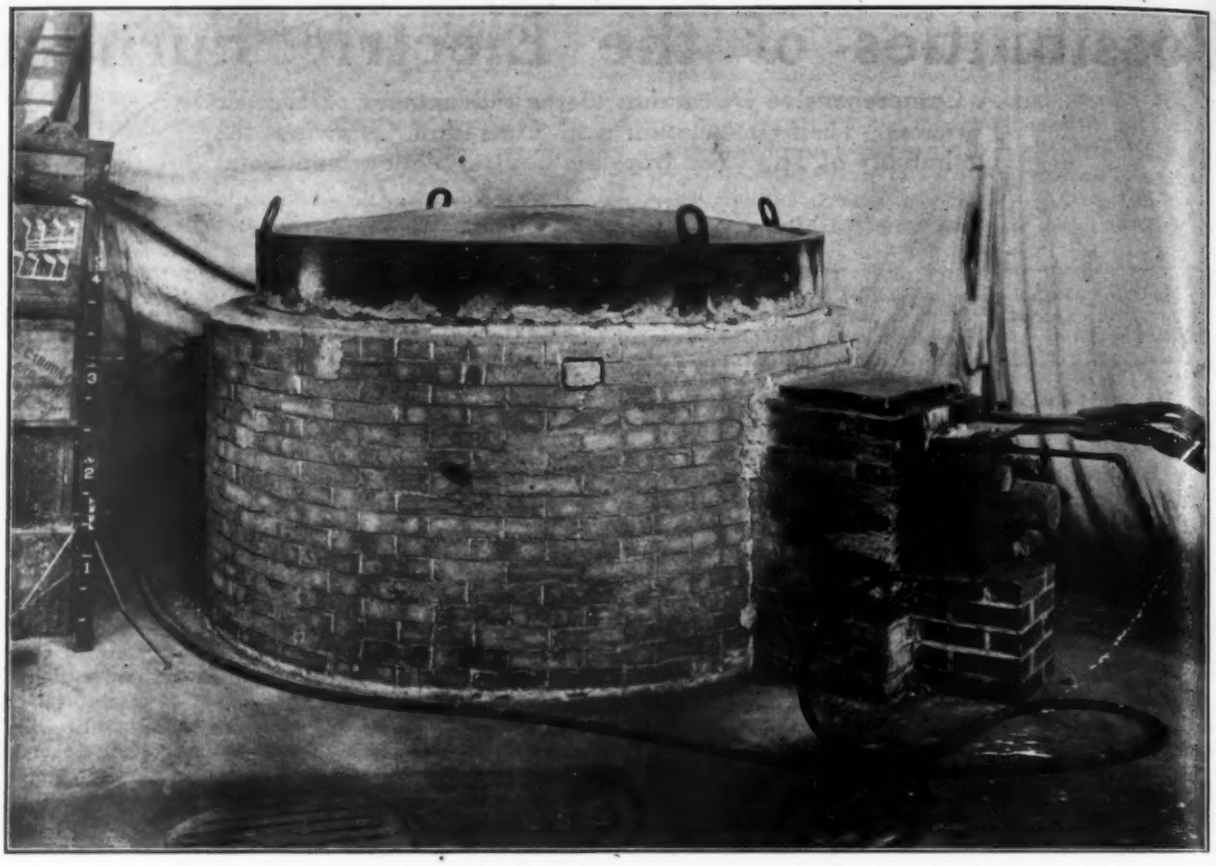
THE input to the furnace is usually controlled by raising or lowering the electrodes. The furnace is also controlled as to connection and disconnection from the power circuit by means of a switch on the primary side of the transformers. In some cases, particularly with the smaller installations, this switch is placed on the low-tension side, as the power for the operation of the electrode motors and the tilting motor, which tilts the furnace for pouring, is taken from the low-tension circuit feeding the furnace. In emergency cases such an arrangement is not generally satisfactory, as no power source independent of the furnace itself is available for controlling and operating the auxiliary equipment. If an electrode sticks, or if it is desired to work on the auxiliary control equipment, it is necessary to open the entire furnace circuit or work on live equipment. It is, therefore, usually desirable to have all auxiliary equipment used in connection with the furnace supplied from a transformer installation independent of the furnace transformers. This arrangement makes the auxiliary equipment self-contained as to operation and entirely independent of furnace troubles and outages.

When an independent circuit is used for the auxiliary equipment an automatic oil switch of the proper rating and rupturing capacity should be connected on the high-tension side of the furnace transformers. This switch can be manually operated or remote controlled, preferably the latter and this control, when used, should be accessible to the furnace for use in case of emergency. If a separate transformer room is built, this switch should be located at that point and the control should be at the furnace. A further objection to a low-tension switch is the large amount of current that must be broken in case of emergency. The presence of the switch in the low-tension circuit is apt to give trouble on account of mechanical construction. The length of secondary leads needed will be increased, thus increasing the impedance of this secondary circuit; also the joints of the switch are apt to get hot and increase the losses.

The amount of reactance that should be present in the secondary circuit supplying an electric melting furnace is a matter somewhat in dispute, and the information available is not of sufficient detail and exactness to be of much



An Electric Furnace in Operation—Man in Foreground is Controlling Tilting Process.



An Electric Furnace for Melting Glass—A Type That Is Coming Into Favor.

value as a means of standardizing practice in making and serving such installations but should usually vary from 10 to 30 per cent. However, it is certain that the desired amount of reactance is dependent on the size of the furnace, the character of the charge, the method and character of the power supply particularly as regards the transmission circuit and other related factors, all of which are variable. The particular value and use of reactance is to cut down the rush of current, at starting and during sudden peaks, which is due to conditions within the furnace. While reactance is of use in adjusting the maximum current drawn from the line, it has a bad effect on power-factor and voltage regulation. This power-factor regulation affects not only the maximum power that can be introduced into the furnace, but it also affects other load that may be taking service from the line supplying the furnace. The capacity of the line is decreased and all transformers are reduced in capacity output on account of the increased flow of wattless current. The greatest difficulty that may be caused by too low a power-factor is the inability of the furnace to make the desired output on account of the impossibility of introducing sufficient heat into the bath and the consequent increased time required for heat. The operating power-factor at the furnace terminals is usually high, from 97 to 98 per cent on the Heroult furnace for example, but the low power-factor that is apt to occur is caused, as explained, by the reactance, inherent or induced, in the leads from the transformer to the furnace, as well as the internal reactance used in all transformers as now designed. Power-factor is, therefore, a variable, subject to considerable adjustment. In a small system a low power-factor could probably be more economically corrected and would give less trouble than the very violent fluctuations which would result if the reactances were largely omitted to give a high power-factor. In very large systems the wide fluctuations and attendant high power-factor are probably a better combination than the steadier load at low power-factor. The particular features affecting this power-factor regulation are principally related to the design of the furnace and the disposition of the secondary cables with reference to each other, and to iron parts which may surround or lie closer to them. While most central stations are satisfied with an average power-factor of from 80 to 85 per cent, some rates are quoted which are especially designed to promote the sale of central-station power to plants using, or who may, use electric furnaces, in which it is specified that the average power-factor shall not decrease below a certain value, and providing a penalty in case such condition is not observed. It is, therefore, worth while to pay particular attention to the conditions external to the furnace, so that highest resultant power-factor may be obtained and without making the arcs too unstable, as such conditions act to make the cost of melting a minimum.

It is frequently stated that the load-factor of an electric furnace load is high, because it usually operates 24 hours per day. This statement must be qualified to the extent of being understood as meaning operating load-factor. The approximate operating load-factor of the furnace for melting uses is from 60 to 70 per cent, but the 24-hour load-factor is less for several very good reasons. When making steel from cold scrap, the demand during approximately the last fifth of the refining period is about 20 per cent less than during the other four-fifths of the period. The same general statement will apply to operations using hot metal except that the total operating period for each heat is thus from one-quarter to one-third as long as when using cold scrap. It may also be pointed out that the present best practice requires that about three times the amount of power be put into the furnace at the start of each run to melt down the charge, when cold scrap is used, as is required later in the heating and refining period when the steel has attained its maximum temperature. Another con-

dition acting to reduce the 24-hour load-factor is the fact that the furnace is frequently entirely disconnected or is operating at a very low demand for from one to three or four hours between heats. Measurements taken at one installation indicate that the weekly load-factor of the furnace installation, based on the maximum integrated hour, was less than 40 per cent. Based on the five-minute peak the weekly load-factor was about 35 per cent, or a little less.

Rates for Electric-Furnace Business.

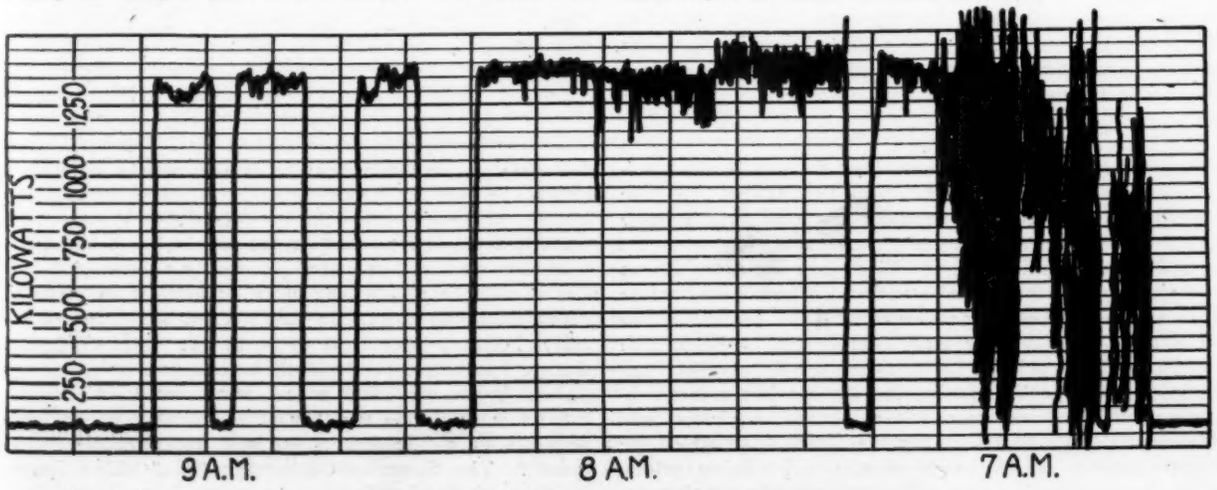
Everything considered, electric furnace business is a very desirable load from the central-station point of view, as under average conditions the operation is at relatively high load-factor and power-factor and is taking current through out a 24-hour day, thus acting to raise the overall station load-factor. In consideration of these features, and in order to promote the use of electric furnaces by making the cost for power such as to give electric-steel melting costs that are comparable with costs for steel melting when carried on by some other method, some central stations are offering low rates especially applicable to such load, or to load operating under similar conditions, with a view to promoting the sale of energy in bulk to loads of this character. These rates usually provide for "off peak" operation on 24-hour notice, and this proviso enables the system operator, or one acting in such capacity, to adjust load conditions to the power-station capacity. The necessity for asking electric-furnace operators to discontinue operation during the peak periods should work no hardship on the furnace operator, as sufficient advance notice will be given to make possible adjustment of production to the known conditions. As this peak period is seldom of more than two hours' duration, the furnace will, of course, retain a large portion of the heat, if disconnected from the line, or the heat content can be maintained constant or nearly so reducing the current input to a mutually satisfactory value and thus adding only heat to replace that radiated, no refining being carried on.

Decision on the proper rate to quote for this class of business will be determined largely by local conditions, and so, as in quoting rates for other classes of service, no fixed rule can be made. The cost of electric power, whether generated from coal or water, location of the plant with relation to source of power supply and fuel market, size of the system, desirability of such business from the standpoint of the particular central station, and other related factors, will all combine to determine what the rate shall be. Usually the power for the operation of furnaces will be supplied at high tension, and will be metered by the central station on the high-tension side. The transformers are essentially an integral part of the furnace installation and are usually furnished with the furnace by the manufacturer. If furnished by the central station, advise as to desired characteristics of voltage, internal reactance, etc., should be obtained from the furnace manufacturer before ordering. When the central-station meter is placed on the high-tension side and billing made from readings taken at this point, special consideration, usually in the form of a discount from the gross bill, is given. The operator will have indicating watt-hour meters installed on the secondary side, as mentioned above, to measure the power input to the furnace and which are of use in indicating just what the electrical input may be at any time during the heat.

The consumption per ton of metal melted and refined will vary according to the practice of the user and to the nature of the product; that is, as to whether the steel produced is in the form of castings, tool steel, alloy steel, etc. Some furnaces give as low a consumption as 450 kilowatt-hours per net ton of plain carbon steel melted and refined, with an average of about 600 to 800 kilowatt-hours per net ton of alloy steel when taken over monthly periods. Small furnaces will have as high a consumption per net ton as 800 to 900 kilowatt-hours for special steels. These figures will vary, as stated, according to the charge and the degree of refining, and also with the size of the furnace and the characteristics as to power-factor and voltage regulation of the power supply. Generally the consumption will be larger for the small furnaces than for the large ones, when the same character of charge is used, and much lower when plain carbon steels are produced.

The transformer capacity installed will also be determined by the size of the furnace and the character of the charge but generally it may be stated that the best practice is to install not less than 400 kilowatts of transformer capacity per ton of furnace capacity for furnaces up to and including three tons in capacity. Furnaces from five to 10 tons in capacity will have 300 kilowatts of transformers per ton of furnace capacity. Above 10 tons the transformer capacity will be from 200 to 300 kilowatts per ton of furnace capacity. Sufficient transformer capacity is desirable in order that the heat put into the furnace in melting down may be sufficient to make the time of melting a minimum thus decreasing the cost of operation.

The electric furnace, in the several different types is now standardized and has come to stay, and the central stations generally are recognizing this fact as evidenced by the willingness to reduce rates to such a point as to make it economically profitable to the manufacturer to substitute such equipment for other equipment that may be in use. This reduction in rates to a mutually profitable basis, together with the continued improvements and refinements in the design and operation of the electric furnace will continue to promote the use of such equipment.



Three-Hour Load Curve of an Electric Furnace.

Status of Government Rate Regulation

A Timely Decussion of the Question as to What Constitutes the Legal Basis for the Government Regulation of Rates

By MORTON G. LLOYD

COMPLETE regulation of privately owned business by government agencies has been widely applied only to public utilities. This has given many persons the impression that the powers of Government in regulation, at least to the extent of stipulating rates, is limited to such public utilities. There is a resulting misconception as to the legal basis for government regulation. The opinion is sometimes expressed that the power of regulation rests upon the existence of a monopoly in the business. Others have attempted to base it upon special privileges extended by the government to the corporations in question, such as the right of eminent domain or the grant of a franchise to occupy public streets and highways. Counsel in a case argued before the Supreme Court of the United States contended that where the right to demand and receive service does not exist in the public, the correlative right of regulation as to rates and charges does not exist. As a matter of fact, established by Supreme Court decisions, none of these elements are essential to the exercise of the regulatory power.

It is not at all surprising that the legal aspect of this question is not thoroughly understood, for not only have prominent lawyers expressed diverse views on the subject, but even justices of the United States Supreme Court have placed dissenting opinions on record. English history shows many instances where Parliament passed laws fixing the price of commodities and even prescribing the rates of wages. Similar enactments were not unknown in the American colonies, but the adoption of the American Constitution was widely regarded as destroying such powers of government. To quote Cooley, an authority on constitutional law: "It has been commonly supposed that a general power in the state to regulate prices was inconsistent with constitutional liberty." This is founded on the fact that the Constitution recognizes the liberty to contract and the right of private property. It seems to be overlooked that there are limitations to the right to contract and that, indeed, all constitutional guarantees are held by the courts to be subordinate to certain necessary powers of the state, such as the police power. This is well illustrated by certain contracts of electric power companies with individual consumers, which have been perfectly valid until the legislature enacted regulatory acts prohibiting discrimination, whereupon such contracts have been declared invalid when brought into court. The theory of the law is that such contracts are entered into subject to the power of the state to exercise regulatory control.

The Effect of the Kansas Decision.

The criteria mentioned in the first paragraph are insufficient to cover even all cases of public utilities, and have been based upon very superficial consideration. In some states, warehouses for storing household furniture are classed as public utilities and subjected to the same degree of regulation as other utilities, yet such warehouses operate without franchise or other special privilege and are in no sense monopolies. They may even decline objectionable business. But regulation as to rates has already been extended beyond public utilities, for Kansas has a law subjecting fire-insurance companies to similar regulation, and this statute has been upheld by the Supreme Court of the United States. Partial regulation, not involving prices, has been extended in many states to cover other businesses, such as banking, insurance, sale of drugs, liquor, etc. And the opinion of the Supreme Court in the Kansas case above referred to definitely enunciatcs the principle that where there is power for any regulation, there is power for complete regulation. The liberty of contract guaranteed by the Constitution is no more involved in price regulation than in other forms of regulation.

The decision of the United States Supreme Court in the Kansas Insurance case (German Alliance Insurance Co. vs. Lewis), decided in 1914, is of momentous importance, as it states more clearly than had before been done the power of the legislature to control business. It extends the scope of that power beyond limits which previously many persons had supposed to restrict it to a rather narrow field. The case of Munn vs. Illinois laid down in a general way the principles upon which regulation is based. That case arose from the attempt of the State of Illinois to fix rates for the storage of grain in elevators. The state was sustained in this power on the principle that when private property is devoted to a public use it is subject to public regulation. Similar cases were later sustained by the Supreme Court of the United States. But all of these earlier cases involved the use of private property, and indeed most of them involved businesses engaged in, or having direct relation to, transportation, distribution or communication.

The business of insurance is, in its characteristics, distinctly different from the public utilities. It involves no use of public property, nor any use of private property for public purposes. It is not a monopoly and it enjoys no special favors conferred by the state. It does not even involve the sale of commodities. It involves merely a contract of indemnity against certain contingencies. If the state has the power under the federal constitution to fix the rates for insurance, it would seem that it has the power to fix the monetary consideration in any contract for the sale of commodities. The opinion in the Kansas case practically admits this right. The right of private contract and the right to dispose of private property are subject to the exercise of such powers as rest in the state.

What Are the State Regulatory Powers.

What, then, determines the right of the state to regulate rates? The answer was enunciated before the birth of this country by the great English jurist, Sir Matthew Hale, and has been reiterated by the Supreme Court. When private property is affected with a public interest, the owner must submit to be controlled by the public for the common good. The principle was originally expressed as to property, but it is not limited in its application to property. It is the business that is the fundamental thing; property is but its instrument, the means of rendering the service which has become of public interest.

Here, then, is the basis for the regulation of business of whatever kind by the state. It is only necessary for that business to be affected by a public interest to make it a suitable subject for regulation. When the effect of contracts between individuals to do or not to do a particular thing stops with the individual there is no reason for regulation. When the effect goes beyond that, it is justified.

Who is to decide whether a business is sufficiently affected with public interest to warrant regulation? The courts? The Supreme Court says "No." This function resides with the legislature. To quote from the opinion in

the Kansas case: "The provisions of the Kansas statute attempt to systematize the control of insurance. * * * Whether the requirements are necessary to the purpose, or whether rate regulation is necessary to the purpose, is a matter for legislative judgment, not judicial. Our function is only to determine the existence of power."

The dissenting opinion in the Kansas case is of especial importance on account of the points raised against regulation, and showing a point of view which was rejected by the majority of the Supreme Court. The dissenting opinion was written by Justice Larmar and was concurred in by two other justices. It claims that failure for 100 years to fix rates for insurance exclude it from the class subject to such regulation; that the power to regulate in other ways does not imply the power to fix rates; that there is a distinction between a public interest justifying regulation, and a public use justifying price fixing; that all cited cases of previous regulation involved business which used tangible property devoted to a public use, and this is a proper criterion of the right to regulate rates; that the power to regulate cannot override the constitutional principle that private property cannot be taken for private purposes; and that the act under review takes property without due process of law and unequally and arbitrarily selects those from which such property shall be taken by price fixing.

It was also claimed that the fact that an insurance company has the option of doing or not doing business under the fixed conditions imposed by the statute is not sufficient to validate an otherwise invalid statute, the Constitution being intended to secure the citizen against being driven out of business by an unconstitutional regulation. It also states: "The fact that insurance is a strictly private and personal contract of indemnity puts it on the extreme outside limit and removes it as far as any business can be from those that are in their nature public."

The dissenting opinion is also of interest in that it points out some of the inevitable conclusions to be drawn from the decision of the court. "If the price of a private and personal contract of indemnity can be regulated, then the price of everything within the circle of business transactions can be regulated." "If, as seems to be implied, the fact that a business may be regulated is to be the test of the power to fix rates, it would follow, since all can be regulated, the price charged by all can be regulated." And finally: "In view of the amount of property employed and the aggregate number of persons engaged in agriculture and the public's absolute dependence upon that pursuit, it would follow that, farming being affected with a broad and definite public interest, the price of wheat and corn; cotton and wool; beef, pork, mutton and poultry; fruit and vegetables, could be fixed."

Limitations of Power of State to Fix Rates.

To sum up the situation, then, the power of the state to regulate rates accompanies the power to regulate in other ways, that is, to put any restrictions upon the freedom of private contract. This power is not based upon any special privilege, upon a condition of monopoly, nor upon the use of private property for public purposes, but exists wherever a business is affected with sufficient public interest. A suggested criterion of sufficient public interest is that the effects or consequences of a contract extend beyond the individuals or corporations making them. The decision as to the necessity or wisdom of regulation rests with the legislative branch of the government. A legal or actual monopoly or a condition of fixed prices may be the motive for regulation but is not an essential condition. The power of rate-regulation or price-fixing is not limited to public utilities and similar lines of business, but extends to contracts of indemnity and even can be applied to the exchange of commodities.

COST SYSTEM IS VITAL TO SUCCESS.

Washing Machine Manufacturers, at Chicago Meeting, Urged to Adopt Plan Developed by National Association.

The two most important problems discussed at the meeting of the American Washing Machine Manufacturers' Association, held at the Hotel Sherman, Chicago, March 21 and 22, were the practical operation of adequate cost systems in washing-machine manufacturing plants, and "efficiency" in operating such plants.

William S. Dodge of the Grinnell Washing Machine Company, led the discussion on cost systems and urged all members to install the practical system compiled by the Association and approved by the Federal Trade Commission.

F. H. LaMonte, of the Management Service Company, Chicago, presented a paper on "Efficiency in Operating Washing Machine Plants," preliminary to a half day's discussion on that subject.

The meeting developed the fact that washing-machine manufacturers, like manufacturers in many other industries, have had difficulties in increasing their production to keep apace with consumer demand. Difficulties in securing raw materials and transportation conditions have curtailed production in many instances.

The plan of adopting a uniform trade acceptance discount was given serious consideration and will be again presented to the Association for action at its next meeting, to be held at Lake Harbor, near Muskegon, Mich., on June 28, 29 and 30.

Atlanta Company Furnishes Service to Plant in 72 Hours After Breakdown.

Approximately 72 hours after the Virginia Bridge & Iron Company, first got in touch with Assistant Sales Manager C. A. Collier, the Georgia Railway & Power Company, Atlanta, Ga., had turned over to the Virginia company's East Point plant the entire equipment necessary for electric drive, and for the first time since its installation the plant of the bridge company was connected with the local electric power lines.

The opportunity to demonstrate what electric drive can do came with the breaking, February 3, of a crank shaft on the engine at the bridge company's plant. It is reported that an expense of $1,800 for repairs was but a minor detail of the situation that ensued, the real embarrassment felt by the bridge company resting in the fact that the shut-down would have to remain complete for at least two months.

The central station was informed of this predicament, Thursday afternoon, February 8. At 10 a. m., February 9, the sales department secured telegraphic order from John K. Graham, vice-president and general manager of the Virginia Bridge & Iron Company, at Roanoke, Va., to cover the installation of electric drive. Work was commenced at once. The company delivered, wired in and installed at the bridge plant one 40-horsepower and one 50-horsepower, 2,200-volt motor, and extended the power lines to the plant; and at 11 a. m., Monday, February 12, some 72 hours after the first call came.

And in addition to that, the total cost of the installation, if it is made permanent, will be about $1,500,—or $300 less than the cost of repairing and re-installing one broken crank shaft.

Underwriters' Laboratories Appoints Council to Supervise Work of Electrical Department.

The Underwriters' Laboratories, Chicago, has announced the appointment of an Electrical Council to supervise the work of its electrical department. This work has heretofore been covered by the Fire Council of the Laboratories, but the work has grown so in volume and importance that it has been judged necessary to appoint a special council for this branch. The initial meeting of the Electrical Council was held at the Machinery Club, New York City, on the evening of March 28.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

Elimination of 15 Additional Isolated Plants Marks Rapid Growth of Power Business in Brooklyn.

The Edison Electric Illuminating Company of Brooklyn reports a 61-per-cent increase in its power business in the first two months of 1917 over the corresponding two months of 1916. The total horsepower amounted to 6,734 as against 4,194 horsepower in 1916. Included in these figures are 15 isolated-plants and steam-engines replaced by Edison service, the most notable of which are the Boorum & Pease Company, large manufacturers of blank books and ledgers, involving 450 horsepower; Rockwood & Company, 1,000 horsepower, largest chocolate manufacturers in Brooklyn and the fourth largest in the United States; Wythe Electric Company, 600 horsepower, manufacturer of shoes; Turner Construction Company, 225 horsepower; and the Metropolitan Macaroni Company, 100 horsepower, largest manufacturer of macaroni in Brooklyn.

The last named contract is of particular importance on account of the large amount of live steam necessary in manufacturing this commodity.

Preparations Made for Summer Appliance Campaign in New Orleans.

The New Orleans (La.) Railway & Light Company is reconstructing one of its show rooms into a model sun parlor in which will be demonstrated all the appropriate electrical appliances which are recommended for use on porches and in sun parlors. The sun parlor is quite an institution in New Orleans, being inclosed in glass during the winter months and used in summer as an out-door dining room, and strong effort is being made to impress upon all consumers the value of electric appliances for preparing meals at the table on these porches.

Ottumwa Company Secures 131 House-Wiring Contracts in Five Weeks.

There is at present in progress in Ottumwa, Ia., a house-wiring campaign that has in a period of five weeks resulted in the securing of 131 contracts for the wiring of already-built houses. While this record is in itself a very credible one for a city of 25,000 inhabitants, it is of distinctly greater interest when it is realized that Ottumwa is one of those old, conservative towns whose population is very largely content with the old order of things.

The Ottumwa Railway & Light Company does no wiring, therefore, in planning the campaign the co-operation of the three local electrical contractors was secured. Uniform prices were agreed upon for a period of 30 days, which was set as the duration of the campaign. A leader in the form of a flat price of $15 for the complete wiring of a five-room house, with drop cords and Mazda lamps, was offered and proved a boon to the campaign.

The central-station company used considerable newspaper advertising and in addition assigned one salesman to the work of following up inquiries. The contractors also actively engaged in closing prospects.

C. E. Fahrney, general manager of the Ottumwa company, reports that the campaign was so successful that it was decided to continue the work for an additional two weeks and to later enter into another campaign, perhaps in the fall.

Good Lighting Makes Your Home As Attractive As Any Other Place To The Young Folks
$15
Will Wire Five Rooms Complete
March 17 Ends The Special
Spring Offer
of the contractors. After that date regular house-wiring prices will prevail.
Decide now to "make your home as attractive as any other place." It will pay in a hundred ways — give you more comfort — more convenience — better light — and the cost will be but a few cents a day.
Put your home in the modern class while you can do it at a substantial saving in cost.
One of these contractors will do the work.
Poling Electric Co. Central Electric Co.
Ottumwa Electric Supply Co.
Telephone 109 for further particulars, but remember, after March 17 prices go back to normal.
Ottumwa Railway & Light Co.
Second and Market Streets
Costs Less To Install Than A New Rug
Costs Less To Enjoy Than Most Necessities
ELECTRIC LIGHT COSTS LESS THAN MILK
Artificial light of some kind is a necessity in these days—so why not have the best light, the most convenient light and most economical light—ELECTRIC LIGHT
An initial expenditure of $15.00 will wire your five room house complete with drop cords and lamps ready to turn on provided you decide to have it done soon and sign the contract
BEFORE MARCH 17
The low price of $15.00 is a special concession of the contractors—offered for a 30 day period only. After March 17th prices go back to normal. One of these contractors will do the work.
OTTUMWA ELECTRIC SUPPLY CO.
CENTRAL ELECTRIC CO.
POLING ELECTRIC CO.
Telephone 109 for full information.
Ottumwa Railway & Light Company
Second and Market Streets

Two Typical Newspaper Advertisements Used in Ottumwa House-Wiring Campaign.

Low Cost of Electricity Shown in Advertisement.

The Union Electric Light & Power Company, St. Louis, Mo., has prepared the copy for an attractive advertisement being shown in the daily papers, and reproduced

Electric Service is the Cheapest of All Household Necessities
ALTHOUGH the food, fuel and clothing used in every home have steadily advanced in price in the last two years the cost of our service has been reduced three times during the same period. And it will keep on getting cheaper as the number of our customers increases.
Contractors tell us, however, that the materials used in house wiring will increase in price shortly. In order to take advantage of the present low cost you must have your house wired now.
No home in St. Louis today can afford to be without electric service. It makes up for its low cost many times over in increased health, convenience and cleanliness.
Have our housewiring specialist call up tell you about our easy payment plan. Your own contractor does the wiring. We pay him and you pay us in small amounts monthly with your light bills.
No deposit required from our residence customers.
Free renewals of all Standard Electric Lamps.
ELECTRICITY IS CHEAP IN ST. LOUIS
THE ELECTRIC COMPANY
UNION ELECTRIC: Main Office:—12th and Locust
Branches: 4912 Delmar 3018 N. Grand; 3012 S. Grand
Six Offices in the County

A Timely Advertisement Showing Low Cost of Electricity.

in the accompanying illustration, in which the reduced rate for electricity is contrasted to the increased cost of other household necessities. This copy is particularly forceful in view of the fact that the electric company has adopted and maintained a policy of decreased cost of energy with an increase in the number of customers, an end which it has steadily accomplished within the past several years.

Rochester Company Secures Important Off-Peak Pumping Contract.

The Eastman Kodak Company, Rochester, N. Y., has installed a large pipe line from Lake Ontario to the Kodak plant, through which its total water supply is to be pumped. The pumping station is located on the lake shore some distance west of the pumping plant of the Rochester & Lake Ontario Water Company. The Eastman Kodak Company has contracted with the Rochester Railway & Light Company for the supply of power to operate this pumping plant. It is expected that at first the load will be about 600 kilowatts and the plant will be so operated as to take advantage of the off-peak rate. It is proposed to operate the plant on two shifts, with a demand of approximately 600 kilowatts during the night hours from 10:00 p. m. to 6:00 a. m., and a demand of 300 kilowatts from 6:00 a. m. to 2:00 p. m.

Atlanta Company Conducts Comprehensive Campaign on Dead Services.

In all cities of any size where it is necessary to require collateral security or deposits from certain classes of customers, and where the parties are constantly moving from one location to another, there are sure to be more or less service connections that are, so to speak, dead. It is not advisable to remove these dead services because of the labor expense involved and the central station never knows when a new tenant will move in and demand service, making it necessary to replace all the work at considerable cost. Since these services are "alive" when supplied from secondary bus lines, the temptation of the new tenant of the building who is not using energy, is to take this service without paying for same. If he does, the company not only loses the current, but the revenue from same. In addition to this feature, the investment for lines, transformers, etc., continues unabated and the utility suffers a further loss on this account.

After giving considerable thought to these matters, the Georgia Railway & Power Company, Atlanta, Ga., adopted the following campaign.

Through the collaboration of the meter department and the department of line records, the sales department obtained an exact list of every service on its system which did not represent an active customer. This list was converted into a card index, arranged alphabetically under streets, the whole index being sub-divided into districts, which districts are handled by individual salesmen. Each salesman then has before him an exact record of every dead service in his territory.

In order for this list to be of any particular value, it must be kept up to date, therefore, copies of all "cut-in" and "cut-out" meter slips each day are sent to one of the men in the office force. If the cut-in list contains any address which appears in the dead-service card file, it shows that this dead service has now become active and the card is removed from the file and destroyed. The clerk also makes a new card which he inserts in the proper place in the card index for every address for which there is a cut-out slip sent in. Therefore, the list is accurate and up-to-date throughout.

Since a certain number of dead services are the results of vacancies, the salesmen are expected to go through all cards showing dead services in their territory and to indicate on these cards those places that are vacant.

The first use that is made of the index is to canvass those tenants occupying buildings in which services are dead, at which time the salesmen ascertains why service it not being used. Proper letters are then sent to these prospects in an effort to induce them to become customers. For instance, if service is not being used because the prospect thinks it too expensive, a letter outlining the economy of electric service would be sent. If the party was not using service because his feelings were injured by the request for a deposit, a letter would be sent explaining to him the sound business principles which demand that deposits be required in a great number of instances. If a party did not particularly need electric service, a letter would be sent outlining the many uses and advantages to be derived from using electric service.

The letters above referred to are of course in addition to and supplementing, the individual efforts of the salesmen.

In order to induce the salesmen to give special attention to this class of business, a prize has been offered to that salesman who succeeds in eliminating the greatest number of dead services in his territory by January 1, 1918.

There is one other feature at present under consideration, viz.: whether the company shall furnish proper advertising cards to the real-estate agents to tack up on houses

which are wired, but vacant. Likewise, the company is considering carrying in the weekly papers, a list of vacant houses which are wired, with the rent asked for each house. This feature is as yet undecided.

As regards the last use made of this index, the company does not make a practice of using meter-protecting devices on its system, and has, therefore, found it necessary to employ an inspector to reduce the theft of current to as low a minimum as possible. This inspector gives special attention to those buildings in which there is service, but no meter, with the result that the amount of theft of current has been decreased to a very great extent in Atlanta.

Rate Reductions Ordered for Kansas City Light & Power Company.

The Public Service Commission of Missouri has issued a report, March 19, ordering a reduction in the rates of the Kansas City (Mo.) Light & Power Company, effective April 17. The new schedule reduces the primary residence rate from 11 cents to eight cents, the secondary rate remaining the same same, five cents. The discount for prompt payment of bills is reduced from 10 to five per cent, and the minimum of 50 cents remains. Rates for general lighting and small power consumers were also reduced.

The marked advance in the cost of operating a light plant, since the evidence was taken on which the opinion is based, would seem to warrant appeal from the order. J. H. Lucas, president of the company, said, however, that there would be no legal proceedings. A statement issued from his office is as follows:

"The order of the Public Service Commission is disappointing to the company. Dr. Shaw who wrote the opinion endeavored to deal fairly and the commissioners agreeing with his conclusions were animated by no other motive than a similar desire to do what they conceived to be right in the matter.

"Still, the opinion is disappointing in the fact that the reduction in rates comes at a time when the high cost of fuel, material and increased public charges in the matter of taxes, general and special, renders the problem of rates one of unusual and serious moment.

"The company has implicit confidence in the fairness of the Commission and the general public, and in this light will adopt the course that will tend to a full and fair settlement of the whole matter. As to litigation—the regulation of public utilities by public service commissions proceeds on the theory that litigation is unnecessary; that if any errors are committed they will be corrected, and in this belief it will be the policy of the company to comply with the order, and rely on the Commission to correct any errors therein."

Appliance Business of Brooklyn Company Increases Over 34 Per Cent for January and February.

The appliance business of the Brooklyn (N. Y.) Edison Company for the first two months of 1917 has shown a marked increase over the corresponding two months of 1916. The percentage increase in gross sales for these two months in 1917 was 34 per cent over the corresponding two months in 1916. The number of articles sold during this period in 1917 was 1,769 as against 1,081 in 1916, an increase of 63 per cent. The wattage of appliances sold during the same period was 312,000 or 30 per cent better than in 1916.

The company finds these increases were general throughout most all the different classes of appliances with a few exceptions, notably, 250 vibrators in 1917 against nine in 1916, 206 heating pads against 95 in 1916.

Indianapolis Company Serves Electrically Cooked Dinner to Women's Press Club.

At a meeting of the Indiana Women's Press Club, held in Indianapolis, Ind., on March 13, an electrically cooked dinner was served by the Merchants Heat & Light Company, to the 42 members in attendance, an electric range having been installed for the purpose. The meal which consisted of fricasseed chicken, mashed potatoes, cream gravy, hot biscuit, apple pie and coffee was prepared in the presence of the guests and by means of a meter, installed for the purpose it was announced that the entire cost of energy used was 27 cents. Following the dinner an address on the advantages of electric cooking was delivered by L. G. Rothschild, special representative of the Merchants company.

Electric cooking received much favorable comment as a result of this dinner. Mindwell Crampton Wilson, president of the Club and publisher of the Carroll County Citizen-Times, of Delphi, Ind., took occasion to publish an extended article on the subject of electricity in general and electric cooking in particular, pointing out its many advantages.

Prospect for Big Power Business in Reading Territory Shown by Survey.

The power sales department of the Metropolitan Electric Company of Reading, Pa., recently completed an industrial survey of the city, which has a population of 125,000 and is the third largest manufacturering center in Pennsylvania having more than 500 industries whose products represent an annual value of $60,000,000.

The result of this survey reveals that there is 24,000 horsepower still available to be electrified, and that it would mean an annual income of approximately $500,000 apportioned among 120 different industries.

These figures, of course, do not take into consideration the growth of each industry now purchasing power, such extensions having been tremendous during the past five years. Nor do they include the contemplated extensions of present customers nor the increased income in prospect from several smaller central stations in growing suburbs, that buy power from the Metropolitan Electric Company to resell. Another industrial survey of the territories supplied by these smaller central stations, is to be made in the near future.

Florida Company Makes Large New-Business Gains.

The Daytona (Fla.) Public Service Company, which does a combined electricity, gas and ice business in that popular winter resort, is making rapid gains in its electric department. During the seven months ending February 1, 1917, 852 meters were added to its lines, making a total of 1,554.

The company is operated by the Gas & Electric Improvement Company, Boston, of which Guy K. Dustin is president. J. C. Lyle is the local manager at Daytona. A large share of its business is during the winter months.

Store and Factory Lighting to Be Pushed in Toledo.

A campaign for the improvement of store and factory lighting is being conducted in Toledo, O., by several noted illuminating engineers working in conjunction with the Toledo Railways & Light Company. The campaign will last about six weeks and during that time it is hoped to call and submit estimates on the cost of proper lighting to all of the leading business houses of the city.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

ESTIMATING FOR THE ELECTRICAL CONTRACTOR.

Determining Unit Labor Costs Under Actual Conditions to Be Met With and Using These in the Estimate.

By E. M. Raetz.

At this season of the year the contractor is being called upon to figure plans almost every day and many will pore over a plan and take off the material, which can generally be done with a degree of accuracy that need cause no discomfort of mind to the estimator, but when we come to the labor item we ponder and think and guess and often wish some fortune-teller could be hired who could tell us all of the unforeseen things which were going to happen on that particular job; then we try to visualize the outlook for the future and pretty soon we see a mental picture of our competitor driving past the store with a load of material and his men going onto this job we are just now figuring and we hate to think we spent the time figuring on these plans for nothing, so we resolve to get just as close as we can on it. So we look over the plans and guess some more and feel again that we would give anything to have some one tell us what the labor on this job will cost.

Suddenly we wonder whether our records would give us any information which would be useful in arriving at a definite conclusion, so we could feel that if our banker asked us how much profit we made on that job we could come right out and truthfully say that we made a "real" profit, not an imaginary one. With this thought in mind we go to our cost book of contracts and find similar jobs which were done under similar conditions, that is, a job done in the same class of building, running over into the winter with slow work and other disadvantages and we decide to get these records in shape to be of use. So we have the cost clerk list the material in lump sums, that is, all the one-half-inch conduit is put under one item, etc. Then we find the labor spent in roughing in the job and apportion this over the roughing material in units, for instance, one-half-inch conduit at five cents per foot, etc., using the National Electrical Contractors' Association estimate blanks. If the amount paid for labor does not correspond with the amount reached by this method, we increase or decrease the unit prices until we have the amount of money paid for labor equal the total from the unit prices we have set opposite each item. With the labor thus distributed over the amount of material used we have an actual history, not a guess of what this work should cost.

Then when we get records of several churches, schools, hotel buildings, etc., we can tabulate the unit costs for the various items and strike an average, allowing for unusual conditions which we know in advance might arise during the progress of the work. Thus we do our figuring on an intelligent basis. Another fine feature about this is that it serves to check the accuracy of your cost-keeping system in that in totaling the various items used we often find discrepancies that have escaped previous notice. Often a whole item is found not to have been charged in the credits for material returned.

It takes time to do these things, but the contractor who does this will be well rewarded, not only in the feeling of satisfaction in knowing that he knows very nearly what his job has cost him, but also in knowing that in bidding on future work he has something definite to go by and that this knowledge has been taken from his own experience under the conditions peculiar to his own surroundings and therefore better fitted for his use than any other collection of data of a general nature taken from some other source or location.

Preparing an Old Electric Toaster for Use by a Hatter.

By R. H. Thiess.

In the better class of stores dealing in men's hats it is the custom to brush each hat carefully before it is wrapped up for the purchaser. The idea is not only to remove the dust which may have accumulated while the hat was on the shelves, but also to smooth the surface fibers. If the latter is done by means of a warm woolen pad stroked around the hat in one general direction, the fibers are all arranged evenly and given a pleasing gloss which at once indicates a new and usually high-priced hat.

A hatter with whom I am acquainted told me about this little trick. In winter he used to keep a pad or two on a steam radiator ready for use. With the approach of milder weather when little steam is needed for heating he was at a loss as to a convenient and safe method for warming the woolen pads. Having an old electric toaster at home I told him I would adapt it for his use. It was one of the horizontal type which had been discarded because of the common burning of bread crumbs that fell upon the heating element and the latter was actually burned out in one section. I replaced this section, thoroughly cleaned up every part of the toaster, buffed the nickel-plated surface, put in a new cord on it with a C-H push-button feed-through switch alongside the toaster and sold it to the hatter at a good figure. To prevent any possibility of the woolen pads becoming ignited, I cut a piece of window screening a little larger than the top surface of the toaster, bent over its edges so it would not slip off, and burned off the black japan paint on the screen so that it would not burn when put over the hot toaster. The toaster has given entire satisfaction for this purpose.

Among the Contractors.

L. C. Fiske, electrical contractor, Beloit, Wis., has made a large addition to his establishment and added considerable new equipment.

P. C. Wallichs and D. Fick have formed the firm of Wallichs & Fick at Fond du Lac, Wis., and will continue the electrical contracting business formerly conducted solely by Mr. Wallichs.

The Northern Electric Company, Duluth, Minn., has just secured the contract for the electrical work on the 600-foot extension of the Northern Pacific Railroad Company's ore dock, now being built at Superior, Wis.

The Reliance Electric Company is the name of a new concern that has opened an electrical store at 909 Pacific Avenue, Tacoma, Wash. G. G. Longmuir, of Pasco, Wash., and G. E. Shroyer, of Portland, Ore., organized the company, which will do a general contracting, supply and repair business.

Brush Composition and Characteristics

The Materials of Which Carbon and Similar Brushes Are Made, How They Are Manufactured and the Physical and Electrical Characteristics Which They Possess

By E. H. MARTINDALE
Chairman, Industrial and Domestic Power Committee, A. I. E. E.

This is the second of a series of fourteen articles treating of the solution of commutator and brush troubles. The first article, published in the issue of March 24, dealt with the development of carbon brushes and the standardization of brush sizes. The remaining articles, appearing at intervals of two weeks, will show the practical importance of the principles already discussed and how they are applied in commutation problems of various kinds of electrical machinery.

DURING the past 10 years or so the carbon manufacturers have been publishing data and curves covering the characteristics of their brushes. Few articles have been written, however, to show the electrician what effect these have on the operation of his machines. This article will briefly discuss the characteristics of carbon brushes and future articles will show how the various combinations are used to overcome machine troubles and how they may be selected to meet the inherent characteristics of the machines.

Composition and Manufacture of Carbon Brushes.

The term "carbon brushes" broadly includes brushes composed of carbon, natural graphite, artificial graphite and a combination of these, layers of carbon and wire gauze, and sometimes is even used to include the metal-graphite or composition brushes.

Carbon is a non-metallic element found in both crystalline and amorphous or non-crystalline form. Natural graphite is carbon in a crystalline form and is mined in a great many localities. Ceylon is probably the biggest source of natural graphite in the world. Amorphous or uncrystallized carbon for brushes may be obtained in the form of lamp black or in the form of coke as a residue of petroleum, a residue of the distillation of coal, or by condensation on the sides of a retort. Artificial graphite is produced by heating amorphous carbon, such as coke, in an electric furnace to change it from the non-crystalline to the crystalline state.

For the higher carrying capacities, brushes have been made up of layers of copper gauze and carbon, the gauze to give the high carrying capacity and the carbon to give the high contact resistance to cut down short-circuit currents. In recent years the demand for high-carrying-capacity brushes for sliprings of rotary convertors as well as for automobile starting motors has resulted in a development of brushes composed of a mixture of graphite and copper or some other metal. The layers of copper gauze and carbon and the mixtures of metal and graphite are always pressed or molded into blocks from which the finished brush is later cut. Some of the carbon and graphite combinations are molded or pressed into blocks, while other combinations are squirted or extruded in long strips. After extruding or molding, the brush blocks or strips are

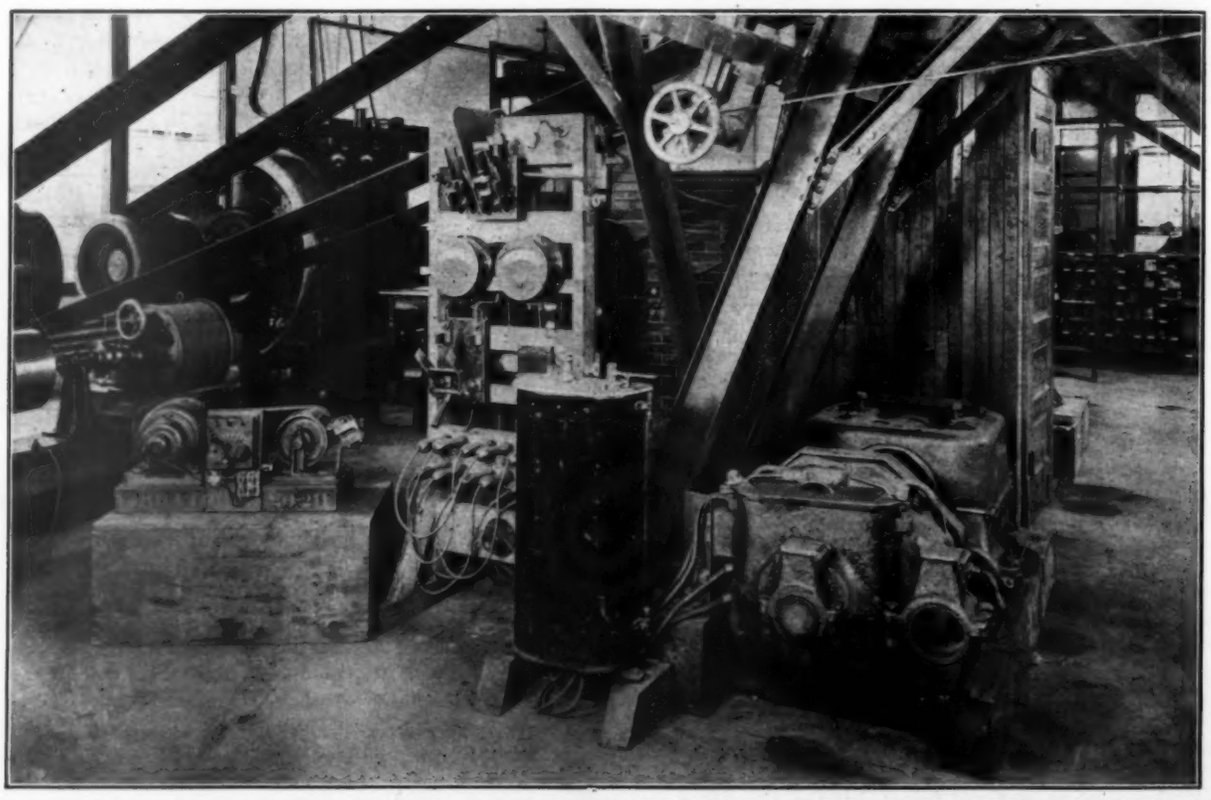


Fig. 1.—A Device, in Left Foreground, for Testing Toughness of Carbon Brushes—A Pressure of Five Pounds per Square Inch is Maintained for Six Hours on Brushes Under Test.

baked somewhat similarly to bricks to reduce the binder to carbon.

Characteristics of Carbon Brushes.

The characteristics of brushes may be divided into two classes, physical and electrical. In the former we have apparent density, real density, strength, hardness, abrasiveness (which is controlled by the percentage and composition of the impurities or ash), co-efficient of friction and toughness. In the latter we have specific resistance, contact resistance or as more generally given contact drop, heat conductivity and carrying capacity.

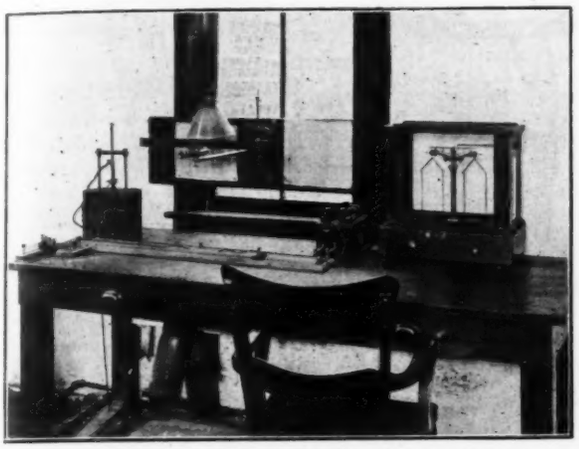


Fig. 2.—Wheatstone Bridge Used to Determine Specific Resistence of Brushes.

Apparent density is the weight of the brush compared to an equal volume of water. In carbon and graphite brushes this varies from 1.18 to 1.75. In metal-graphite composition brushes this varies from 2.2 to 6.9. Other characteristics are so much more important that apparent density usually does not enter to a very great extent into the selection of the best brush for a machine. Other characteristics being the same, a brush with low apparent density will, on account of its low inertia, operate better than one with a high apparent density on a high-speed commutator which is slightly eccentric, as it can follow the movement of the commutator quicker. Brushes with high apparent density, particularly those of metal-graphite composition, require high brush pressures to overcome the inertia of the brushes and maintain good contact.

Real density is the density of the materials from which the brush is made. The difference between the apparent density and real density and this divided by the real density is the percentage porosity of the brush.

Strength is the transverse breaking strength of the brush expressed in pounds per square inch. It is used mainly by the manufacturers as a check on the uniformity of their products.

The *hardness* of a brush is usually obtained by a scleroscope, an instrument designed to test the hardness of steel. The result is really a combination of hardness and elasticity. Thus, some metal-graphite brushes which are somewhat malleable show an apparent hardness much lower than the actual hardness. Hardness of carbon and graphite brushes varies from six to 80. Other characteristics being suitable for a machine, a hard brush will give a longer life than a soft brush. Relative hardness is frequently determined by cutting a brush with a knife, but if more accuracy is desired by the layman it is recommended that a set of pencils varying from 2B to 8H be used. A pencil softer than the brush will mark upon it and one harder will scratch it.

The *abrasiveness* or scouring property of a brush should be carefully distinguished from hardness. Pure carbon in the form of lamp black, coke or graphite as found in brushes has no abrasive quality. Impurities are nearly always present and are generally called ash because the rest of the brush can be burned. The most common impurities are silica, quartz, iron oxide, mica and carborundum. Of these, quartz and carborundum are the most abrasive. A soft brush will have a greater abrasive action than a hard brush with the same amount of impurities, due to the faster mechanical wear of the brush. Abrasive action is necessary on many machines to keep the mica flush with the commutator bars and also to keep the commutator polished.

Co-efficient of friction is the ratio of the pull exerted by the commutator on the brush to the pressure of the brush on the commutator. The next article in this series will deal so fully with this very important characteristic that it is unnecessary to treat it further here.

The *toughness* of a brush may be defined as its ability to withstand chattering without breaking or chipping away at the edges. At the left in Fig. 1 in the foreground is shown a vibrator for testing this quality. It consists of a ratchet wheel, eight inches in diameter, driven at 360 revolutions per minute by a small motor. There are eight steps on the wheel one-eighth inch deep. The brush used is two and three-quarters inches long by two and three-eighths inches wide by one-half inch thick. A pressure of six pounds per brush, or five pounds per square inch of cross section, is maintained. To be satisfactory for railway-motor service a brush must withstand this severe test for six hours without serious chipping or excessive hammer wear. A six-hour test is approximately 130,000 revolutions and produces considerably over 1,000,000 vibrations of the brush.

Specific resistance of a brush is the resistance in ohms of a cube whose sides are one inch. Fig. 2 shows a Wheatstone bridge used to determine specific resistance. A brush two and one-half inches by one-half inch by one-half inch is placed in the clamp on the block shown on the left-hand edge of the table. Amalgam contacts are necessary to prevent appreciable resistance between the ends of the carbon test piece and the clamp. The sliding contact is moved along the wire until there is no deflection of the galvanometer. The resistance is then read from a table of previous computations.

Contact resistance is the resistance between the moving commutator or slipring and the brush, expressed in ohms per square inch of contact surface. The resistance varies inversely as the current density and in almost direct ratio. It is therefore customary to express this characteristic in terms of contact drop, which is the product of the current and contact resistance and is a nearly constant value for a given brush operating at a constant pressure on a given surface irrespective of the current density. The next article will deal with this characteristic fully.

By *heat conductivity* we mean the rapidity with which a brush will conduct heat from one point to another. No standard has been set for this characteristic in brushes, but in general it may be stated that the lower the resistance of a brush the greater is its heat conductivity. Thus low-resistance graphite brushes have much greater heat conductivity than corresponding high-resistance carbon or graphite brushes.

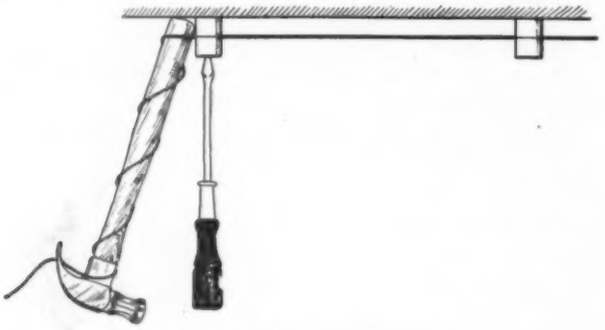
The *carrying capacity* of a brush is a figure set by the carbon manufacturers to indicate the number of amperes per square inch of cross section which the brush will carry under average service conditions. This figure takes into account heating due to average overloads, friction, short-circuit currents, contact drop, and sparking and is the result of extended experience rather than of physical tests on the brush material.

As stated early in this article, nearly all of the characteristics defined herein will be treated in more detail in later articles of this series.

USEFUL WIRING HINTS

A collection of some short-cut or otherwise valuable suggestions which, though not entirely new, are not as well known by wiremen as they deserve to be. Most of these suggestions have been submitted for publication as "Dollar Wiring Kinks," which department is intended for new and original ideas only and will reappear soon.

Tightening Wires in Open Work.—To make a neat job in open-work wiring the wires must be well drawn taut before the cleats are fastened. Wires ranging from No. 12 to No. 6 can easily be tightened by taking a hammer, as shown in the

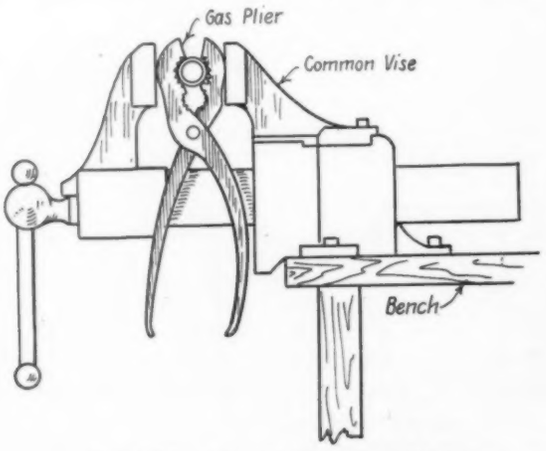


Simple Way to Tighten Wires.

sketch, and using it as a lever with one hand while tightening screws in cleat with the other hand. W. Morris.

Handy Way to Carry Soldering Paste.—When working on a high ladder with torch in one hand and solder in the other, it is very difficult to find a good and handy place for the can of soldering paste. I have solved this by means of a spring brass clip that I solder to the side of the can. It can then be hooked on top of the overalls or the edge of a coat or shirt pocket, just like a fountain pen. This saves much time and trouble. The cover of the can does not have to be taken off every time you want to use paste. If you carry the can in your pocket and the cover comes off it makes an "awful" mess. This scheme is especially handy for the fixture hanger. O. Hingel.

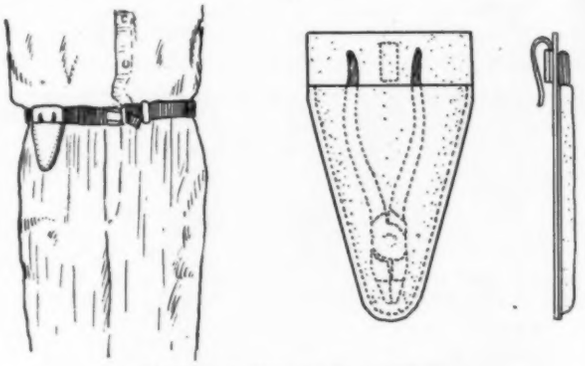
Common Bench Vise as a Pipe Vise.—Making up fixtures involves cutting and threading of very short nipples, and an ordinary pipe vise cannot be used to any advantage, unless one has the proper pipe chucks to hold the pipe. For this purpose I find it much easier to use a common vise and a pair of gas pliers. Simply grasp the nipple to be threaded or cut with the gas pliers and put them in the vise, either horizontal or vertical whichever way may be



Bench Vise Adapted for Fixture Work.

best, and you have a good pipe vise that will not slip or injure small pipe. J. R. Peterson.

To Prevent Forgetting Pliers.—To the man who has gone to a job and gotten ready to use his pliers and then found that he had left them "in the shop," the following may be helpful. Make a small leather case or have it made at a

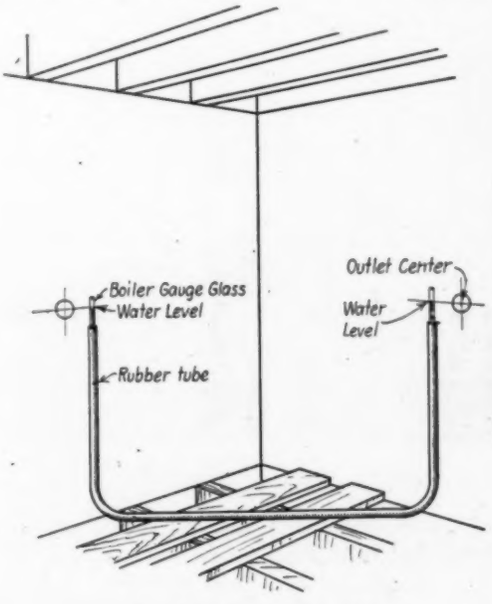


Convenient Way to Carry Pliers.

harness shop, if you desire, just about large enough and of the right shape to fit what you consider a handy size of pliers. Have a clip on the back to slide over your belt and keep it there. You can easily acquire the habit of keeping your pliers in it. This will also save your pockets. I have found that having a definite place for important tools goes a long way to insure having them in their place. Arthur S. Nickerson.

Reducing Coupling Made at the Job.—Reducing couplings can be made right on the job, when no regular couplings are at hand, by taking a coupling, such as a one-inch and threading a piece of one-inch pipe with about three or four threads, so that the coupling will fit on about half way. Next saw the pipe off close to the coupling and tap it out for three-quarter-inch pipe. When you have this done you have a three-quarter-inch by one-inch reducing coupling. Make other sizes in the same manner. W. Morris.

Marking Off Level Outlets While Roughing In.—When it is desired to center outlets on a wall exactly, as in the case of outlets placed in woodwork panels, and if the floors and ceilings are too uneven to measure from, I have found that a rubber hose with glass tubes on each end and filled with water makes a perfect level for this purpose. The sketch shows how it is used. R. R. Knoerr.



Leveling Outlet Centers.

DEALER AND STOREKEEPER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Storekeeping for the Dealer in Electrical Appliances

Advertising by Means of Uniform Color Scheme for Vehicles.

In view of the large number of automobiles in service in the electrical field, it seems to be worth while for dealers to adopt definite colors for their cars, by means of which to distinguish them and thus advertise the business. Sometimes a concern will have half a dozen cars, including the passenger autos used by the salesmen and collectors and the service wagons of the repair and construction crews. If in addition to carrying the name of the company each of these cars were painted a given color, the town would soon learn to recognize the insignia.

Window Demonstrations Aid Cleaner Sales.

The dealer whose store front is illustrated herewith attributes practically all of his success in a recent vacuum-cleaner campaign to the demonstrations which were conducted in one of the show windows. A clever innovation was the employment of a popular school girl each day to demonstrate the cleaning powers of the electric. This feature served a double purpose. First, it drew the attention of all passers-by because of the human interest in the window and secondly, it emphasized the fact that an inexperienced girl could obtain satisfactory results with the electric cleaner.

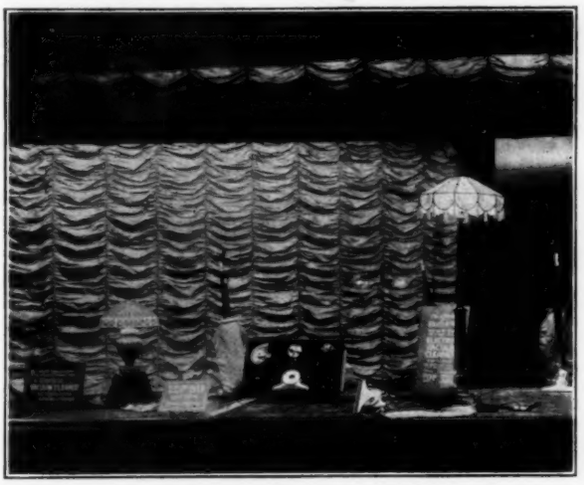
A Human-Interest Vacuum Cleaner Window.

The window on the left was utilized to display the various sizes of cleaners on sale.

It is a significant fact that many men were attracted to the window displays and numerous sales were made to them.

Education a Factor in Cleaner Sales.

In this enlightened age it seems that every household using electricity for lighting must also realize the advantages of at least the more common electrical appliances. Nevertheless, it has been the usual experience to find the prospect totally



An Educational Window Display—All Working Parts of the Vacuum Cleaner Are Conspicuously Displayed To Show the Rugged Construction of the Machine.

ignorant of the essential facts in regard to the use of such appliances, particularly as to first cost, cost of operation and rugged construction and reliability. The wide-awake dealer, therefore, realizes the importance of education in a sales campaign, and keeps this in mind in preparing literature, advertisement, in window displays, etc.

The accompanying illustration shows a window display of vacuum cleaners which has for its main purpose the education of the spectator in the construction and operation of the type of machine on sale. A display board showing all of the principal parts forms a conspicuous part of the exhibit. Cleaners are also shown in various positions to reveal their construction and numerous pertinent posters in the window give data as to operating costs.

Splendid Example of Manufacturer and Dealer Co-Operation.

It is interesting to note the efforts put forth by electrical appliance manufacturers to assist the dealer and central station in marketing such devices.

The Hotpoint Electric Heating Company, Ontario, Cal., Chicago, New York, Toronto, and London, offers from its Co-operative Department and Day-Load Bureau, which are maintained purely for dealer and lighting company service, many special free features in the way of newspaper copy, advertising, cuts, window displays, window-trimming material, and folders.

This service is availed of by nearly 10,000 dealers and central stations handling electrical appliances and during 1916 more than six million pieces of printed literature for presentation to the consumer were distributed free of charge, in addition to the hundreds of special campaigns.

An Advertisement That Sold 143 Vacuum Cleaners.

The value of newspaper advertising in selling vacuum cleaners is convincingly demonstrated by the experience of

$200

Brings You This

Thor

Vacuum Cleaner

Last Chance Offer! Prices Going Up!

Then you can pay the balance at the rate of only $2.00 a month. Nearly a year in which to pay—and you use it all the time. That is our offer. But you must act **at once!** Telephone or come to the Thor Shop in Jackson boulevard right away.

The Thor Electric Vacuum Cleaner is made right here in Chicago. Guaranteed by a home company—the company that makes the famous Thor Electric Washing Machine.

Here's your chance!—a chance to keep your rugs and carpets beautifully clean, while you save all the weary work of sweeping and the nuisance of frequent dusting. Learn what a wonderful time saver, labor saver and all around comfort the Thor Cleaner is. Come in and see our demonstration! Watch the Thor run over the floor and suck all the dust and dirt up into a bag—all in a jiffy.

Your Last Chance! Prices Going Up!

Our offer of this $30 cleaner for $22.50 expires in a few days. We challenge competition at the low price we have made. You positively cannot get a better cleaner any place for less than $30. Come and be convinced. The one criticism of this extraordinary No. 5 is that the price is too low. We know that. We have held the price down as long as we can. Rising material costs force us to go up. So—**act now!** This announcement alone will dispose of hundreds. So come early to avoid disappointment.

You Would Expect to Pay $30 But It's Yours for $22.50

At its price of $22.50 the No. 5 is an amazing value. Steel construction. Very light and strong. Has General Electric horizontal motor. Also the famous nozzle comb or "thread picker," which picks up all the lint, threads and ravelings that are so difficult to sweep up. Rubber tired wheels. Large suction nozzle. Snap switch in handle. Handle stands upright.

Now offered for only $2.00 down—then $2.00 per month (5% interest charged on deferred payments). Don't miss this sensational offer. You cannot find it duplicated. Seize this chance at once. If you delay it will be **too late!**

Come or Phone To-Morrow—Come to the Thor Electric Shop. Let us demonstrate the No. 5. Don't let another day pass without seeing it. No obligation to buy. Just come and watch the fascinating sight and be convinced. You owe it to yourself to do this. Come.

The Thor Electric Shop

24 E. Jackson Blvd. 6 Doors East of Hub Phone Franklin 1082 **Bet. State and Wabash**

One Insertion of This Advertisement Resulted in 143 Sales.

the Thor Electric Shop, Chicago, Ill. in selling 143 electric vacuum cleaners from a single insertion of the advertisement reproduced herewith. Of course the fact that the offer made in this advertisement constituted the last opportunity to purchase the cleaner in question, before a raise in price, had much to do with the results. Also the appeal to the housewife of having the use of the machine while paying for it on extremely easy terms was a factor.

The Thor Electric Shop, located in the exclusive retail shopping district of Chicago, deals entirely in vacuum cleaners and washing machines and depends for a considerable share of its business upon the consistent use of liberal space in the newspapers. Demonstrations in the store are also an important feature of its sales work.

Employees' Courtesy Wins Customers' Favor.

Service is one of the chief standards by which the success of a business organization is measured. There should be engendered a feeling of thorough co-operation and good fellowship between the public and any public service company. It is an asset that which can be developed to a great degree. The following letter was received by the Merchants Heat & Light Company, of Indianapolis, Ind., from the Vonnegut Hardware Company, of that city, and speaks for itself.

"Gentlemen:—I have had the conditions below happen so persistently (consistently) that I believe it will interest you. Talked with men regarding light service in first place and they were extremely courteous. Purchased lamps from young lady and she was courteous. Talked over telephone regarding meter being in wrong place and he was courteous. Talked with another regarding system of sending me cards to read meter on account of no one being home so your man could get in and you had put meter inside house and he was courteous. Last night lights went out and after waiting for a couple of hours got in touch with your man and to my surprise he was more than courteous. He explained just what the trouble was and that he had a man or men out then (and you did). I am sure any company would like to hear the report as above regarding their men."

Reasons Why Rent for Fans Should Be Paid in Advance.

When fans are rented wise dealers collect the rent in advance. This is a cardinal rule, the value of which is borne out by the experience of many seasons.

The rentals involve comparatively small amounts, to begin with, and for the reasons shown above are likely to be lost sight of if not collected promptly. Furthermore, those who rent fans are often of a transient character. They may be in the community for only a short time and have not the sense of responsibility which attaches to a settled householder, about whose credit there is some definite information.

The rental should be collected in advance every month; and if the payment is not forthcoming promptly, the fan should be returned. A postcard should be used to notify renters of the expiration of the period for which rental was paid, and advising that if additional use is desired the amount for the next month must be remitted. These notices should be followed up in five days, either for the repossession of the fans or the collection of the money.

One reason for the necessity of making the rental tariff sufficiently high is because of the moral hazard involved. The class of people likely to call for fans is not always of the highest, and the dealer should figure on losing a certain percentage of this equipment, while other units will be damaged, requiring repair work.

The rent business is all right if handled properly—but it has its troubles, which must be guarded against.

Suggestions for Collecting Small Dealer Accounts.

A veteran dealer recently made the statement that the largest credit losses are the small ones. This sounds like a paradox, but the meaning is clear when it is remembered that the small bills are the ones to which least attention is paid. Usually in the case of an account amounting to only a dollar or two the dealer sends out his bills right along, or even takes the heroic measure of writing "Please remit" in red ink at the bottom. However, if the customer doesn't see fit to pay nothing is done. The electrical merchant is so busy attending to current business that he gives little attention to the collection of old accounts, and many of them consequently go by default.

In the case of an important account, where the payment is looked forward to to take care of some obligation of the merchant, all due effort is put forward. If the customer doesn't pay promptly personal calls follow, and he is not allowed to forget that the amount is due. The result is usually that no accounts of consequence are lost if the loss can be prevented. There are failures, etc., which result in loss of the money, but this does not fall into the class of lost accounts which are being discussed here.

The minor account, because of its individual unimportance, gets comparatively little attention from the boss. Those who owe the money often forget just what it was that resulted in the charge, and the "Bill rendered" statement received the first of every month fails to make an impression. And so it goes, until the books are all cluttered up with a lot of small accounts which aren't worth anything in that form to the dealer, but should be converted into cash and make a live asset in the business.

Personal work is what is needed in a case of this kind. If the inside work permits it, a member of the office force should go out on the street regularly and work on these delinquent customers. If not, a paid collector should be employed. A bright boy with plenty of persistence and tact can exhaust the patience of many a member of the slow-pay family and more than earn his salary; and an employee of this kind not infrequently develops into a right-hand man, and put in charge of the credits and collections end of the business.

A method which is sometimes worked successfully is to use the telephone for the purpose of stimulating collections. This requires some diplomacy, as well as an appeal to the customer along somewhat different lines from those usually used. A girl who has a sympathetic voice is best qualified to handle this feature.

"Mr. Jones," she says, "we are endeavoring to clean up all the old accounts on our books this month. Won't you help us out by sending a check? Will you attend to it today? Thank you so much, Mr. Jones!"

A little scheme of this kind is easy to put into effect, and usually brings in a lot of money which would remain out indefinitely.

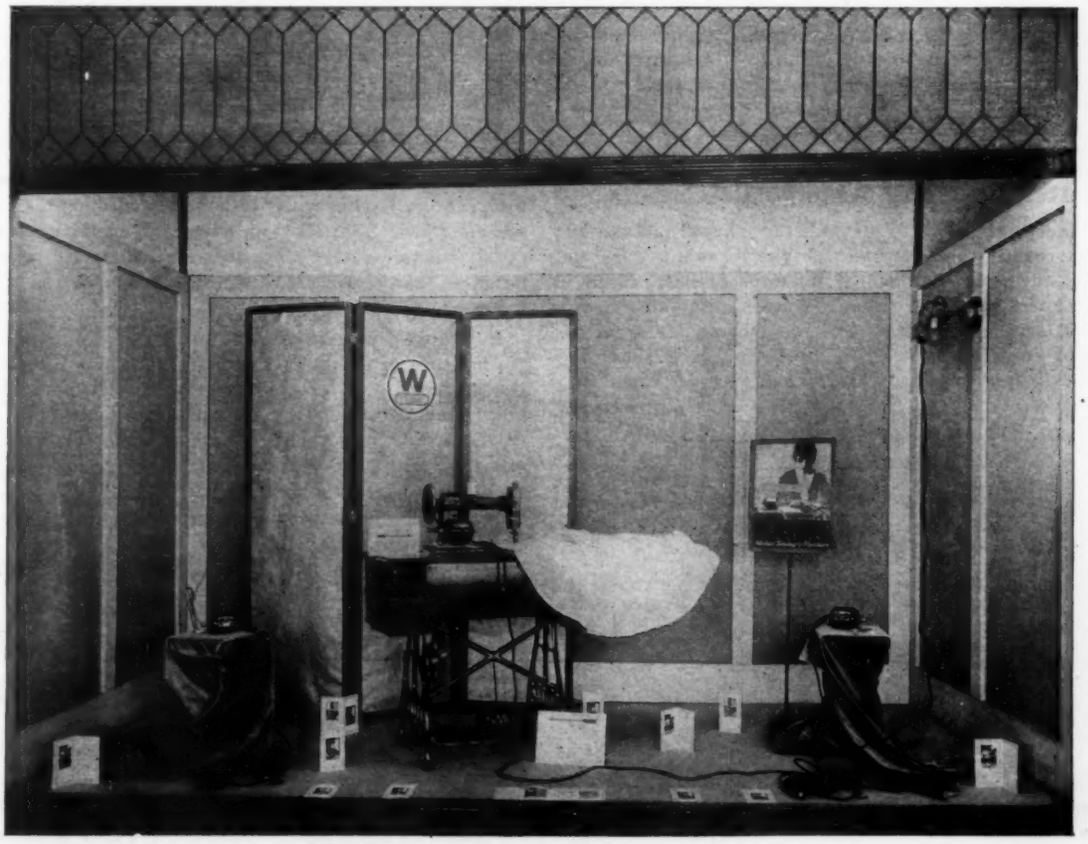
Do Your Windows Reflect the Seasonal Spirit?

Doing the right thing at the right time invariably leads to success, be it in the conduct of your business or the trimming of your display windows. There is such a thing as the psychological moment in window trimming, for the current of popular thought runs in various channels according to the seasons of the year. Naturally, people are interested in different things in the spring than they are in the fall. In addition, every holiday creates a distinctive atmosphere. In order, therefore, to be most effective in converting casual glances to actual sales, the window display should reflect the seasonal spirit, thus assuring not only the ready attention of the passing throngs, but also hastening the decision of prospective purchasers. The dealer then who embodies in his windows the trend of popular thought has secured an avenue of approach for his sales arguments that cannot be secured in any other way.

Along toward the spring of the year when the women folk begin to plan their spring sewing is just the time to show them how easy it is to sew by electricity. An attractive display of sewing-machine motors will reach more women with less expense than any other method that can be employed. The display will also appeal to the men, as it is a recognized fact that men are becoming more and more interested in the purchase of labor-saving devices for the home.

Bond Measure for Utility Companies Annulled.—Governor Edge of New Jersey has vetoed the proposed law, adopted by the Legislature, to permit utility companies in the state to issue bonds and stock certificates for expenditures outside of the state without the permission of the Board of Public Utility Commissioners. This bill (Senate Bill No. 170, introduced by Senator McCran) the governor holds is not practicable, but approving, at the same time, with its purpose to limit the jurisdiction of the utility commission over the issuance of such securities of public utility companies to their property within the state.

Year's Construction by Wisconsin Telephone.—During the past year the Wisconsin Telephone Company has expended $2,013,467 for new construction, as compared with $1,494,835 during the previous 12 months, according to reports read at the annual meeting of the stockholders in Milwaukee. During 1916 repairs and replacements cost the corporation $827,420, as compared with $763,034 for the year of 1915.



An Attractive Sewing-Machine Window Display.

The display illustrated above was installed under the direction of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., and features the company's new sew-motor. While the arrangement is simple, the display is of such a nature as to attract attention, the fundamental principles having been worked out by window-trimming experts.

NEW APPLIANCES

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

Improved Outlet-Box Receptacle.

The firm of Harvey Hubbell, Incorporated, Bridgeport, Conn., has recently redesigned its outlet-box receptacle No. 6103, which is used quite extensively in its outlet boxes and conduit fittings. As now built this receptacle has a sub-base having for its purpose the protection of the wires from contact with the box or fitting. The wire passages are well rounded and free from all sharp edges or corners, thus minimizing the wear on the wire insulation due to

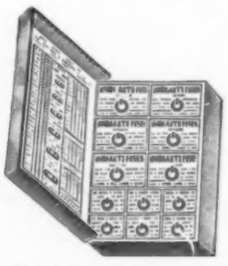
Hubbell Outlet-Box Receptacle.

friction and also reducing the possibility of accidental short-circuits through contact of exposed wire fitting.

This receptacle is designed for mounting in the cover which is securely attached between the upper and center porcelain by means of a single center screw. A leather gasket is furnished for insertion between the two porcelains in order to take up any variation and to insure proper rigidity of the cover. The slots in the receptacle are of the new standard T type with which all Hubbell 10-ampere caps and lamp receptacles are interchangeable.

Assorted Fuses for Automobile Circuits.

One does not need to attend the annual automobile shows to realize the enormous output of motor cars and especially the great number of different makes. Even in so small an item as the fuses for the lighting or starting circuits, a large variety is required to accommodate various designs of cars. Dealers have some trouble in determining what types, amperages and quantities of fuses they should have, if they wish to carry as little slow-moving stock as possible, and to assist them the "Union" line of



Assortment of 100 Glass and Fiber Automobile Fuses.

automobile fuses is now furnished in three assortments, known as No. 1, 2 and 3, and containing respectively 100, 200 and 150 fuses, selected after careful study of average requirements and neatly packed in a case with compartments for the various sizes. Complete details can be secured from automobile jobbers or from the manufacturer, the Chicago Fuse Manufacturing Company, Chicago.

The Motrola for Electrically Operating Phonographs.

To transform satisfactorily a device that previously has been operated by hand to one operated mechanically, the effect obtained must be as nearly the same in principle as that formerly employed, or else must be an improvement thereon. This is especially true in the case of phonographs. The turntable of such a machine must turn at an even rate of speed. This can be accomplished probably best through the medium of the spring motor in the machine. Where an electric motor operates the turntable by friction, irrespective of the spring motor, the results may be unsatisfactory, owing to the fact that extremely fine control cannot on ordinary circuits be obtained and there is bound to be a variation in speed with the slightest fluctuation in the voltage of the supply circuit. This variation in speed of the selection being played at the time, while not always noticeable by the ordinary individual, is very objectionable to a musician. To secure mechanical operation in as nearly as possible the same manner as that obtained by hand operation, and to assure even speed, the device employed should only be utilized to wind up the spring motor of the talking machine. This is what is done by the Jones Motrola.

The Motrola consists of a very small motor finished in gold and black, and a cutout switch actuated by a spring. The motor may readily be connected to the ordinary electric light socket by means of the cord and plug furnished. It is connected to the spring motor of the phonograph by worm and gear, with a crank shaft designed to take the place of the handle with which all hand-operated machines are equipped. The Motrola keeps the spring motor wound at all times without any attention whatever, when once mounted and connected to the circuit, in the following manner:

A strong spring in the motor housing operates against the pressure of the spring motor in the talking machine. When the spring motor runs down to a certain predetermined point, the spring in the Motrola overcomes the pressure of the spring motor and trips a cutout switch, automatically connecting the electric motor to the circuit. The motor then rotates the crank shaft, winding up the spring motor until it is almost fully wound, when the spring motor overcomes the spring in the electric motor device and the cutout switch automatically disconnects the Motrola from the circuit again. A button is provided, however, so that the actions of the motor may be controlled manually when desired, as for instance, when it is not desired to have the motor running during the playing of a selection. In this case, by depressing the button before placing the record on the machine one can make certain that the spring is fully wound.

In mounting the Motrola it is only necessary to remove the hand crank, replacing it with one furnished with the motor and to attach a plate for holding the motor in position. The Jones Motrola is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., for Jones Motrola, Incorporated, New York City, which markets it exclusively.

Popular Electric Vacuum Cleaners

An Assortment of the Best Known Portable and Stationary Types of Cleaners for use in Residences, Apartments, Clubs, Hotels, Public Buildings, Etc.

Apex type A-3 Suction cleaner for residence use. Machine is only 6½ inches high and has broad poking nozzle able to get under furniture, etc. Air passage subdivided to give uniform suction over nozzle width. The Apex Electrical Manufacturing Company, Cleveland, O.

Apex B-1 or "submarine" type for use in large homes, hotels, offices, etc. More powerful than the A-3, but equally able to get under things. Has very large cleaning surface, riffled-rib nozzle, automatic adjustment and traction-operated revolving brush.

Bissell suction cleaner. A powerful cleaner with ½-horsepower motor capable of moving 80 cubic feet of air per minute. Hose 1½ inches in diameter. Can be operated as blower and provided with power base for general utility service. The Bissell Motor Company, Toledo, O.

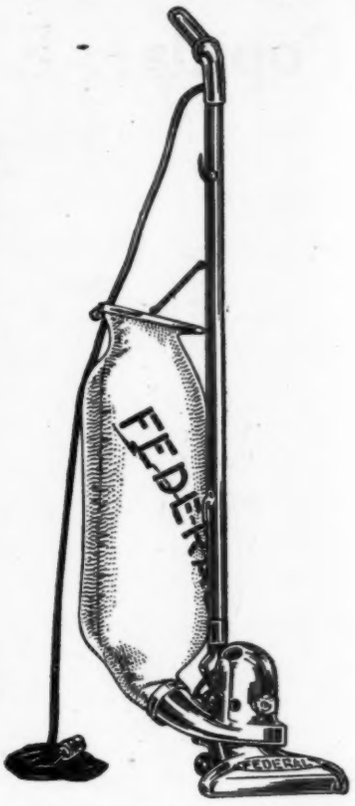
Little Ben vacuum cleaner. A light-weight machine for household use. Patented pistol-grip handle. Every part of machine, including motor, made by Clements Manufacturing Company, Chicago, Ill.

Reliable vacuum cleaner. Patented friction-driven bristle brush for picking up lint, thread, large particles of dirt, etc. Also made in other models. Clements Manufacturing Company, Chicago, Ill.

Duntley twin-pump electric cleaner. A portable and powerful machine developing vacuum of 10 inches mercury on test. Height 21 inches, base oval shape, weight 35 pounds complete. Mounted on four ball-bearing swivel casters and provided with full set of cleaning tools. Can also be used as blower. The Duntley Company, Chicago, Ill.

Duntley electric sweeper. Body only five inches high to pass under furniture readily. Universal air-cooled motor. Adjustable 12-inch nozzle. Dust bag of special texture. Adjustable handle. Special set of cleaning tools, including 1.25-inch hose, furnished extra. The Duntley Company, Chicago, Ill.

Federal type C cleaner. A powerful cleaner for hotels, hospitals, etc. Rotary pump driven by ¼-horsepower motor. Very durable and quietly operating machine entirely inclosed in steel and aluminum case. Has 11 attachments. Federal Sign System (Electric), Chicago.



Federal electric cleaner with universal, vertical, air-cooled motor. Total weight 10 pounds. Nozzle 12 inches by one inch. Rear caster adustable to change nozzle height. Closely woven double dust bag. Federal Sign System (Electric), Chicago.

Frantz Premier cleaner. Weight complete 9 pounds. Extra wide nozzle adjustable for thickness of rugs. Includes rubber-tipped automatic revolving brush. The Frantz Premier Company, Cleveland, O.

View of Frantz Premier cleaner in use with one of the extra attachments. Every part of the outfit, including motor, is made in the new large factory of The Frantz Premier Company at Cleveland, O.

Hoover suction sweeper with phantom view of nozzle, showing the patented, motor-driven, soft-hair brush, which is claimed to shake and sweep the rug as well as clean by suction. Made in four sizes, two for household use and two for big offices, stores, institutions, etc. The Hoover Suction Sweeper Company, New Berlin, O.

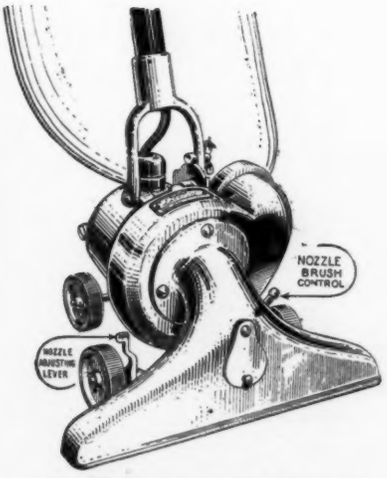
Hotpoint model L with nickel-finished pressed-steel case and air-cooled universal motor. Nozzle is 12 inches long and has spring-pressed brush. Adjustable rear caster. Double-lined dust bag. Pear-shaped handle grip. Weight complete 11 pounds. Hotpoint Electric Heating Company, Ontario, Cal.

Hotpoint model M with cast-aluminum case and air-cooled universal horizontal motor. Rotary brush geared to revolve in reverse direction to cleaner, set in 12-inch nozzle. Height to top of bag flange 7¾ inches. Weight complete 11½ pounds. Hotpoint Electric Heating Company.

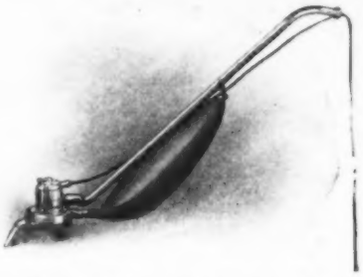
Thor No. 12 vacuum cleaner. A powerful cleaner for large homes, offices, etc. Entire body is made of polished steel. Nozzle is 12 inches wide and contains a patented rubber comb for picking up hair, threads and surface dirt; comb may be raised or lowered as desired to suit nature of carpet being cleaned. Swiveling caster at the rear. Rubber bumper in front to protect furniture. Hurley Machine Company, Chicago, Ill.

Thor No. 5 vacuum cleaner. A strong little machine with welded steel body weighing only 8½ pounds complete. Nine-inch nozzle with rubber comb. Rubber hose and special tools for cleaning moldings, portieres, mattresses, couches, etc., readily attached by removing cap directly above the word Thor. Insertion of attachments automatically cuts off suction from the nozzle below. Hurley Machine Company, Chicago, Ill.

Liberty model B with cast-aluminum body and General Electric horizontal universal motor. Mounted on four wheels and easy running. Width of nozzle 12 inches. Weight 10 pounds. Innovation Electric Company, New York, N. Y.

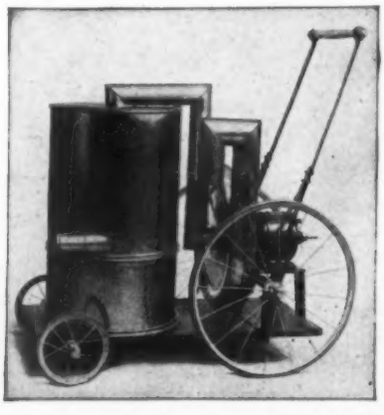


Enlarged view of Liberty model B mechanism, showing shape of nozzle, which contains straight self-cleaning brush that is thrown into or out of action by lever. Another lever raises and lowers nozzle for different thicknesses of carpet. Innovation Electric Company is also about to market a model C with traction-driven revolving brush.



Invincible Baby cleaner with 1/12-horsepower universal motor. Self-adjusting and swiveling handle is detachable and can be used with hose and the nozzle, which is also detachable. Can also be used as a blower. Smallest of an extensive line, but capable of producing 9-inch vacuum. Invincible Manufacturing Company, Pittsburgh, Pa.

Invincible Junior two-stage cleaner. Equipped with ¼-horsepower vertical-shaft motor. Dust collector is at top of machine and is easily removed for cleaning by lifting directly out of top. Powerful and substantially built portable machine. Provided with various attachments, including 1¼-inch hose and set of cleaning tools. Invincible Manufacturing Company.



Victor semi-portable cleaner. A powerful cleaner for use in churches, stores, theaters, etc., where it is impractical to pipe for stationary plant. Dust and dirt easily removed from receptacle at bottom. George S. Knox Company, Wilkinsburg, Pa.

Invincible Junior truck. Has 1/3-horsepower motor and three-stage turbo fan. A heavy-duty machine for portable work. Special dust separator and collector of large capacity to avoid frequent emptying. Produces high vacuum and can also be used for blowing. Equipped with 1½-inch reinforced hose, tools and attachments. Invincible Manufacturing Company.

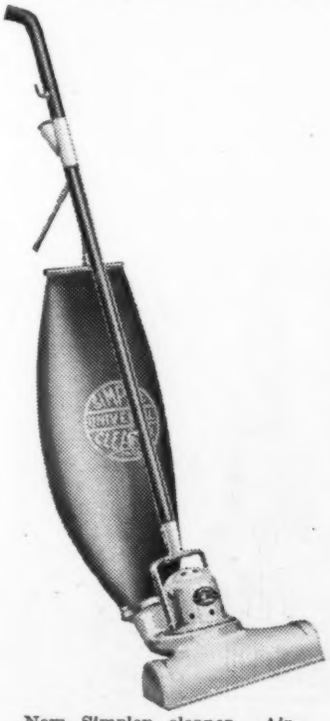
Invincible heavy-duty cleaner truck. Made in three sizes with ½, 1 and 1½-horsepower motors. Semi-portable machine for heavy-duty vacuum cleaning and blowing in large offices, hotels, factories, etc., not piped for stationary plants. Invincible Manufacturing Company, Pittsburgh, Pa., also makes stationary plants of various sizes up to 15-horsepower, capable of operating up to six sweepers simultaneously.

Torrington Electric Vac. Bottom view of nickeled-steel nozzle, showing brush which revolves in opposite direction to movement of cleaner and has three rows of bristle tufts; brush is easily adjustable. National Sweeper Company, Torrington, Conn.

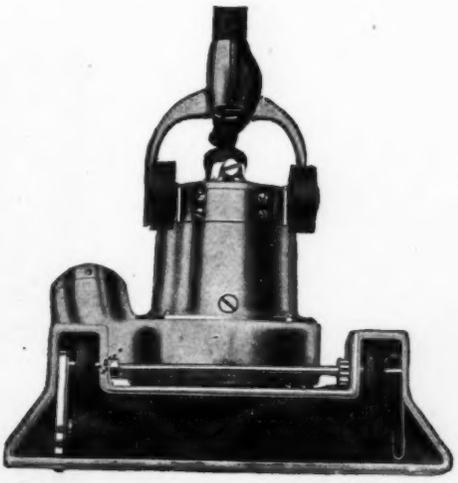
Torrington Electric Vac. Universal horizontal motor, air-cooled by fan. Wheel bearings outside of nozzle. Bag has over 550 square inches of filtering surface. National Sweeper Company, Torrington, Conn.

Alladin Electric. Universal horizontal 1/12-horsepower motor. Steel nozzle 12 inches wide with bristle brush revolving in opposite direction to motion of cleaner. Exceptionally easy running machine of lower price than the Torrington Electric Vac. National Sweeper Company, Torrington, Conn.

Electric Sweeper-Vac. Compact cleaner with nickeled-steel body and nozzle. In latter is motor-driven brush with new worm-gear drive, mechanism of which is outside of nozzle and fully inclosed. Robbins & Myers horizontal balanced motor with fan on one end of shaft and brush drive on other. Total weight, 11 pounds. Pneuvac Company, Boston, Mass.



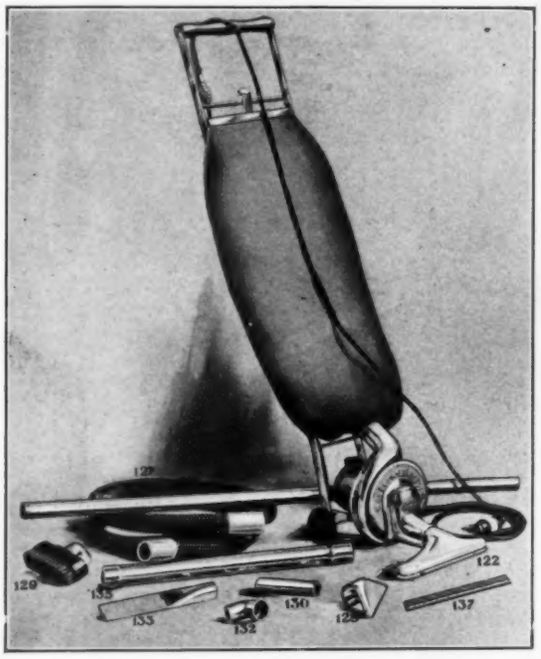
New Simplex cleaner. Air-cooled vertical motor. Nozzle 12½ inches wide with revolving brush driven by fiber gears. Machine only 6 inches high and weighs 9 pounds. Neatly constructed. The Ramey Company, Chillicothe, O.



Bottom view of Regina models K and L, showing the 12-inch suction nozzle with its revolving brush. Latter is actuated through gears by movement of machine over the carpet and is self-adjusting. At right end of nozzle is knob for adjusting its height. The Regina Company, New York City.

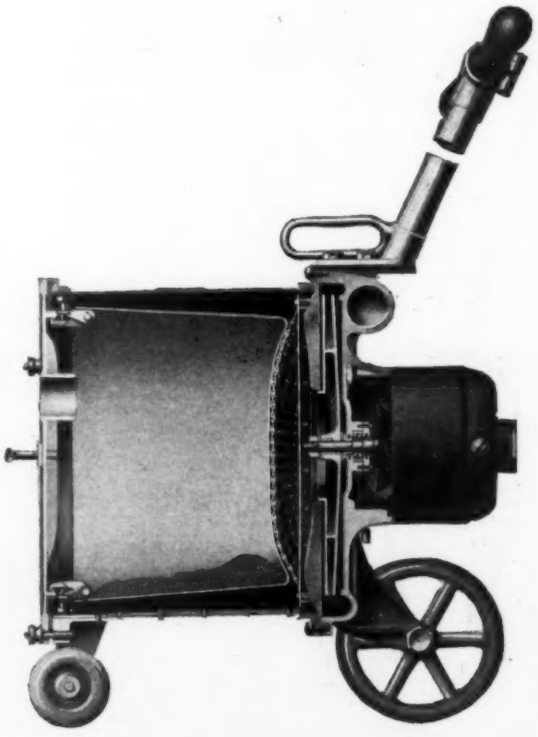
Regina electric cleaner. Both models K and L are similar in design, but latter has a larger and more powerful motor. Case largely of aluminum giving light weight to entire outfit. Hose and other attachments are fastened at round plate in front. The Regina Company, New York City.

Regina model MC cleaner. A compact machine with inclosed dust bag. Twelve-inch nozzle with positively driven revolving brush. Body height 7¾ inches, length 19½ inches. Attachments connected by removing round cap in front above nozzle. Finished in nickel plate, aluminum and gray enamel. The Regina Company, New York City.

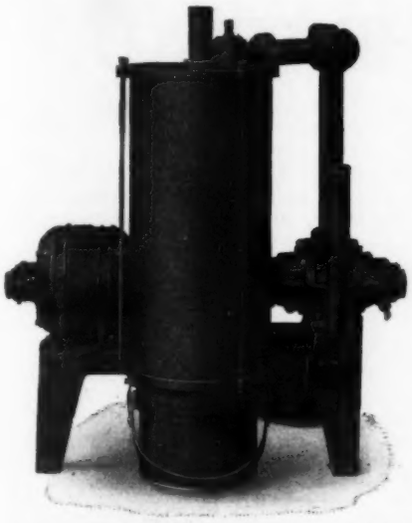


Western Electric No. 11 with its attachments. Floor nozzle is not permanently connected to machine, but may be readily detached and other tools or connecting hose substituted. Strong double handle with secure bag support and convenient control switch. Entire machine can be hung in shallow closet. Western Electric Company, New York City.

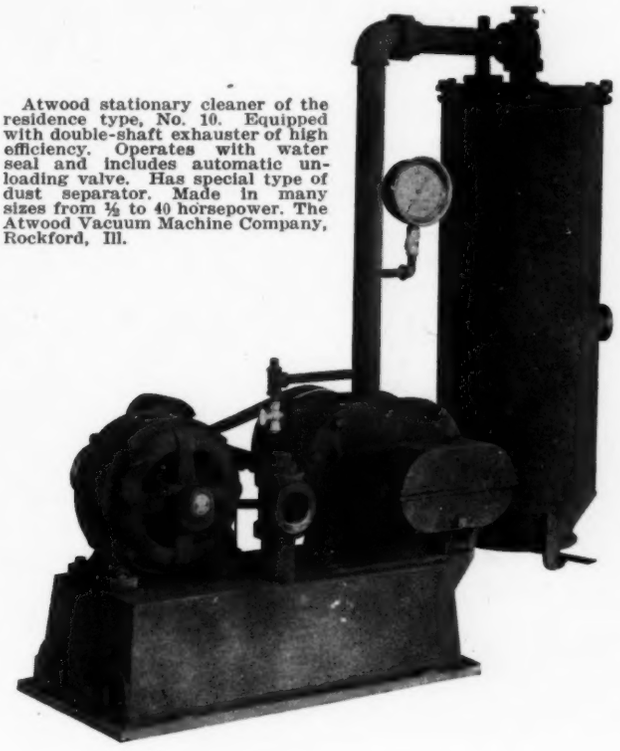
Western Electric No. 2. This is a larger and more powerful cleaner than the No. 11. Specially designed for use in larger homes where there are thick rugs and draperies. Machine is well balanced and easily moved about; when taken up or down stairs it can be either carried or handled like a baby cart. Manufacturer also makes still larger portable and several stationary types of cleaners. Western Electric Company, New York City.



Section through fan and dust compartment of Western Electric No. 2. Dusty air enters through orifice shown at left, to which hose is attached. The dust is entirely deposited in the bottom of the bag where it is undisturbed by the air passing through the filtering diaphragm and then through the fan at the right. The front cover and bag can easily be removed as a unit and need not be opened until emptied outdoors or in the basement. Western Electric Company.



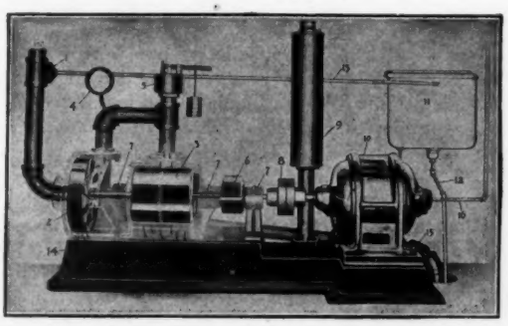
Arco Wand stationary type electric cleaner. A simple, substantial and powerful machine with cycloidal rotary pump, said to be exceptionally efficient for vacuum work. Dust is discharged into separator and falls into tightly sealed metal dust bucket at bottom, which can be easily emptied. Built in several sizes, also mounted on truck.



Atwood stationary cleaner of the residence type, No. 10. Equipped with double-shaft exhauster of high efficiency. Operates with water seal and includes automatic unloading valve. Has special type of dust separator. Made in many sizes from ½ to 40 horsepower. The Atwood Vacuum Machine Company, Rockford, Ill.

Kent stationary "Kleaner." Built on turbine-pump principle and has but one moving element. Dust and dirt discharged into dust pan and can be emptied when necessary. Foul air is exhausted into chimney. Uses no cloth or screen for dust separation. The Kent Vacuum Cleaner Company, Inc., Rome, N. Y.

Victor stationary cleaner. Very simple in construction and operation. Machine needs cleaning out but once a year and oiling twice a year. Built for relatively low vacuum but large air volume. Installed with large-size non-choking piping and equipped with special cleaning tools. George S. Knox Company, Wilkinsburg, Pa.



Connersville vacuum cleaner for laundries and carpet-cleaning establishments. Employs the Connersville double-impeller rotary blower. Develops up to 12-inch (mercury) vacuum to permit fast cleaning with little power. Uses unique centrifugal separator by which dirt and water are separated from exhaust air and discharged into sewer. United Vacuum Appliance Company, Connersville, Ind.

ACTIVITIES IN THE TRADE

Crouse-Hinds Company, Syracuse, N. Y., has issued bulletin No. 302, descriptive of Imperial flood-light projectors and Imperial reflectors.

Sangamo Electric Company, Springfield, Ill., has issued bulletin No. 46, descriptive of its type "H" single-phase and polyphase alternating-current watthour meters.

Westinghouse Employees Hold Annual Dinner.—Nearly 500 employees of the Westinghouse Electric & Manufacturing Company participated in the seventh annual dinner given under the auspices of the Westinghouse company in Pittsburgh March 24. H. D. Shute, treasurer of the company, presided, and the principal speakers were Farley M. Osgood, assistant general manager of the Public Service Electric Company, Newark, N. J., and E. M. Herr, president of the Westinghouse company.

Armstrong Cork & Insulation Company, Pittsburgh, Pa., has issued an attractive 32-page booklet entitled "Reducing Noise and Vibration," which gives the methods applied to motors, fans, printing presses and other machinery. For this purpose the company is manufacturing nonpareil cork machinery isolation which is composed of granulated cork compressed in metal molds and then baked. The resiliency, elasticity and strength of the resulting material recommend it for use in mounting machinery.

Walter B. Snow, advertising specialist, 136 Federal Street, Boston, Mass., has announced the addition of the following men to his staff: Mr. Frank C. Thomas, formerly advertising manager of the Cadillac Motor Car Company, later manager of the Cleveland office of the J. Walter Thompson Company and recently connected with the advertising department of *Hardware Age;* C. C. Jones, former manager of *System's* advertisers' service bureau, and recently with the Greenleaf Company; C. W. North, formerly in charge of the art department of *Iron Age* and *Hardware Age.*

Northern Cedar Company is the new corporate name of the Northern Mercantile Company, Ltd., and the location of its general offices has been changed from Sandpoint, Idaho, to Spokane, Wash., the latter change being made so the company may keep in closer touch with the trade and its stocks of Western red cedar poles. The changes do not affect the personnel of the organization, and the business will be continued along the same conservative lines as in the past, but with stronger organization, larger stocks and better facilities for handling its business. The company handles the best grade of western red cedar poles and is placed in an exceptionally advantageous position for making prompt deliveries of plain and butt-treated poles.

National Metal Molding Company, Pittsburgh, Pa., has issued bulletin No. 50, on rigid steel conduit; bulletin No. 151, on non-metallic flexible conduit, and bulletin No. 350, on locknuts and bushings. These bulletins are worthy of extended comment because of their form, which is that of a correspondence folder. The company before making the change gave careful consideration to the subject of standard sizes for catalogs and finally decided to present the data on its various products in the form of separate bulletins on each, each bulletin bound in a correspondence folder, properly indexed for filing, according to materials or name of manufacturer, and of a size to fit any standard vertical letter file. The varying sizes and shapes in which catalogs have been published has made it almost impossible to maintain uniform and convenient filing systems, and the method proposed by the National Metal Molding Company is a good suggestion for solving catalog filing problems.

The B. F. Goodrich Company, Akron, O., has changed its name to The B. F. Goodrich Rubber Company and has announced that W. A. Means, treasurer of the company, has been elected second vice-president, and L. D. Brown, cashier of the First-Second National Bank of Akron, has been elected treasurer to succeed Mr. Means.

Standard Electric Service Company is the name of a new concern incorporated by Fred G. Dustin, Charles W. Arrick and Emil Anderson, with offices at 239 Plymouth Building, Minneapolis, Minn., for the purpose of dealing in electrical machinery and doing electrical construction work and wiring for light, heat, power and signals. Two years ago Messrs. Dustin and Arrick formed the Standard Electric Company for the same purpose and have continued the business in a very successful manner. With the addition of Mr. Anderson the firm name was changed and the company incorporated. It will assume all the liabilities and assets of the Standard Electric Company and continue the business. The members of the firm are well known to the electrical fraternity as popular and progressive electrical men. Each has been particularly active in the Western Association of Electrical Inspectors, Mr. Anderson now being president of that organization.

Gear Manufacturers Form Organization.—An organization of gear manufacturers was formed at Lakewood, N. J., at a meeting held there March 25-27. It will be known as the American Gear Manufacturers' Association, and its purposes are to advance and improve the gear industry in a general way by standardization of gear design, manufacture and application. The association includes in its membership the foremost and better known manufacturers of gears. The executive committee is composed of the following: F. W. Sinram, Van Dorn & Dutton Company, Cleveland, O.; H. E. Eberhardt, Newark Gear Cutting Machine Company, Newark, N. J.; F. D. Hamlin, Earle Gear & Machine Company, Philadelphia, Pa.; Frank Horsburgh, Horsburgh & Scott, Cleveland, O.; Biddle Arthur, Simonds Manufacturing Company, Pittsburgh, Pa.; G. L. Markland, Philadelphia Gear Works, Philadelphia, Pa., and Milton Rupert, R. D. Nuttall Company, Pittsburgh, Pa. The officers elected at the Lakewood meeting are: F. W. Sinram, president; H. E. Eberhardt, vice-president; F. D. Hamlin, secretary, and Frank Horsburgh, treasurer. The next meeting of the association will be held at Pittsburgh May 14-15.

The Frantz Premier Company, Cleveland, O., has developed a novel selling plan for use in co-operating with dealers for the retailing of vacuum cleaners. The company has had a central-station man, who is also an expert on mail-order copy, working with dealers and central-station companies for several years in developing this plan, and now has arrangements standardized and perfected. Briefly, the plan is that the central-station company or dealer co-operates by furnishing a limited amount of advertising space, the copy being standardized and furnished together with illustrations by the Franz Premier Company, which also furnishes trained retail salesmen to sell cleaners in co-operation with the merchandiser. In cases when it is the policy of the central-station company to leave the sale of electric appliances entirely with dealers, the Frantz Premier Company succeeds in getting the combined co-operation of dealers and central station. The company furnishes attractive circulars, lithographic posters, street-car cards, display cards and racks, etc., to aid in the merchandising. The plan has proved very successful wherever tried and is credited as being an efficient means of securing the desired results, that of selling vacuum cleaners and increasing the central-station company's day load.

PERSONAL AND BIOGRAPHICAL

MR. W. S. RUGG, formerly district manager of the New York office of the Westinghouse Electric & Manufacturing Company, succeeds MR. CHARLES S. COOK as manager of the Railway Department, with headquarters at East Pittsburgh, Pa. Mr. Rugg was born at Broadhead, Wis., and is a graduate of Cornell University.

W. S. Rugg.

His connection with the Westinghouse company dates back to the early days when the company had its plant at Garrison Alley in Pittsburgh. Later he was transferred to the Chicago office, and in 1901 he went to the New York office as a special engineer. In 1909 he became district manager of the New York office, which position he has held until this time. Mr. Rugg has been prominently identified with the work of the American Institute of Electrical Engineers, serving for a time as one of its managers.

MR. E. D. KILBURN, manager of the Power Department of the New York office of the Westinghouse Electric & Manufacturing Company, has been appointed district manager of that office, to succeed MR. W. S. RUGG. Mr. Kilburn is a graduate of Cornell University. After leaving college he became identified with the Westinghouse company, at East Pittsburgh, later being transferred to the Syracuse office. Afterwards Mr. Kilburn entered the employ of the Westinghouse Machine Company, with headquarters at New Haven, Conn., from which position he was transferred in 1915 to the New York office of the Westinghouse Electric & Manufacturing Company, to become manager of the Power Department. In November, 1916, his duties were enlarged to include the management of the Railway and Lighting Department of the company's office in New York City.

MR. EDWARD R. KELSEY, advertising manager of the Toledo (O.) Railways & Light Company, was recently elected governor of the Rotarians for the departments of Ohio, Indiana and Michigan at the election held at Wheeling, W. Va.

MR. L. S. MONTGOMERY has joined the sales organization of the American Conduit Manufacturing Company, of Pittsburgh, and will operate from the company's office in New York City. Formerly he was manager of the Buffalo (N. Y.) office of the National Metal Molding Company, of Pittsburgh.

MR. HARRY C. BROWN, formerly assistant secretary of the National Electrical Contractors' Association, has been appointed secretary of the association and editor and business manager of the official journal, the *National Electrical Contractor*, following the resignation of MR. GEORGE H. DUFFIELD from those positions. Mr. Brown is well and favorably known to the electrical fraternity through his connection as traveling representative of the Crouse-Hinds Company, of Syracuse, N. Y., for a number of years, and this experience, together with his association work, fits him to do admirable work in the important position he now holds in the contractors association.

MR. F. A. OTTO, who has been secretary-treasurer of the Minnesota Electrical Association the past four years, was elected to the presidency of that organization at its recent convention in St. Paul. Mr. Otto is a native of St. Paul and was educated at the University of Minnesota, graduating in 1904 from the course in electrical engineering. He entered the employ of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., but later returned to St. Paul to accept a position with the St. Paul Gas Light Company, with which company he has been connected 13 years, the last five of which he has been superintendent of the electrical department. Recently he resigned that position to become general manager of the Minnesota Gas & Electric Company, Albert Lea, Minn. Mr. Otto's activities in electrical organizations have been many, and besides the Minnesota Electrical Association he is a member of the American Institute of Electrical Engineers, National Electric Light Association and the Jovian Order, and vice-president of the State Board of Electricity.

F. A. Otto.

MR. WASHINGTON DEVEREUX, who was elected to the presidency of the National Association of Electrical Inspectors, is chief of the electrical department of the Philadelphia Fire Underwriters' Association. Mr. Devereux began his electrical career in June, 1880, with the Bell Telephone Company of Pennsylvania, since which time he has been engaged in the electrical industry constantly, both in the United States and the West Indies. Mr. Devereux is one of the best known electrical inspectors in the country and has been exceedingly active in every movement for improving electrical construction and business conditions in the electrical industry, both in Philadelphia and throughout the country. He is the originator of the Electrical Conference which meets once a month and comprises inspectors and district managers of the Philadelphia Electric Company, municipal inspectors, electrical contractors and mechanics, and inspectors of the Philadelphia Fire Underwriters' Association. This conference discusses Code regulations and methods of co-operation between the various branches of the electrical industry. Mr. Devereux is the author of "The Electrical Key," which is the standard booklet used by the Electrical Inspection Bureau. He is a member of a large number of engineering and civic societies, in many of which he has been very active, particularly the Engineers' Club of Philadelphia, of which he was vice-president, and the Jovian Order, of which he was statesman for the Eastern District of Pennsylvania from 1910 to 1912.

Washington Devereux.

MR. E. E. BROWNELL, of Philadelphia, Pa., consulting electrical engineer, has been retained by the city of Trenton, N. J., to make investigations of electrolysis destruction of the city water lines.

MR. H. H. LYONS, who has been connected for the past five years with the Arkansas Valley Railway, Light & Power Company, of Pueblo, Colo., has been appointed district superintendent of a new division of that company, which includes Ordway, Sugar City, Crowley and Olney Springs, Colo.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

AUGUSTA, ME.—The Central Maine Power Company has commenced construction work on a transmission line from Orland to Castine.

ESSEX JUNCTION, VT.—The new hydroelectric station of the Burlington Light & Power Company is nearly completed. About 10,000 kilowatts will be available. The development here was started in 1913.

WATERBURY, VT.—Alterations and additions to the plant of the Montpelier & Barre Light & Power Company here are being made. New power installations in connection with the granite working industry have greatly increased the company's power load.

AVON, MASS.—The Union Electric Light & Power Company is soon to extend its lines to serve outlying farms.

MILLBURY, MASS.—The Worcester Suburban Electrical Company is considering a number of extensions to its local distribution system.

PITTSFIELD, MASS.—It is reported that surveys are being made for the transmission of power from a point in the Adirondacks to the Pittsfield and Schenectady plants of the General Electric Company, and that there is contemplated one of the most extensive systems of power development ever undertaken in this country by the transmission of electric power from Speyer Falls, N. Y., through Schenectady and to Pittsfield, a distance of approximately 175 miles.

WINCHENDON, MASS.—The Massachusetts Gas and Electric Light Commission has approved a petition of the Winchendon Electric Light & Power Company for permission to issue $258,000 in new capital stock, to meet costs of extensions.

WORCESTER, MASS.—Directors of the Worcester Electric Light Company have authorized a contract with the Westinghouse company for a 20,000-kilovolt-ampere turbogenerator, a duplicate of one ordered in February, 1916. The two new units are expected to take care of the company's increasing business for some time to come.

LONG ISLAND CITY, N. Y.—The Public Service Commission has granted the Patchogue Electric Lighting Company permission to issue stock for $60,000 for new equipment for lines and station, and to reimburse its treasury for expenditures.

LONG ISLAND CITY, N. Y.—The Public Service Commission has granted the Long Island Lighting Company permission to acquire the following companies and properties: Suffolk Gas & Electric Company, Huntington Light & Power Company, Huntington Gas Company and the South Shore Gas Company.

NEW YORK, N. Y.—The Interborough Rapid Transit Company, 165 Broadway, will build a new two and four-story boiler plant at its yards, at 239th Street, to cost about $70,000. The structure will be 57 by 101 feet.

PARISHVILLE, N. Y.—Myron Roberts, of this place, has purchased from the A. Sherman Lumber Company its local waterpower sites and proposes to develop them fully.

ROCKVILLE CENTRE, LONG ISLAND, N. Y.—E. G. Wright, president of the village, is advocating extensions to the street-lighting system.

SYRACUSE, N. Y.—The New York State Railways will make improvements and extensions in its local system to cost about $500,000. Besides new track work and extensions to lines in different sections, with new rolling stock, the improvements will include new electric equipment at the various stations and substations.

CLOSTER, N. J.—The Rockland Electric Company has been granted permission by the Board of Public Utility Commissioners to extend its lines in East Crescent Avenue, Allendale.

DOVER, N. J.—The New Jersey Power & Light Company is now operating its new generating station at Dover, with capacity of about 3,500 kilowatts and has closed its former Boonton plant. The local plant will be increased in capacity to 7,000 kilowatts by the installation of a new 3,500-kilowatt unit and two 500-horsepower boilers before the close of the year.

ELIZABETH, N. J.—Initial steps toward the establishment of a municipal electric light and power plant were taken at a conference between the Finance Committee of the City Council and the Board of Works. The latter probably will be authorized to employ experts to investigate the probable cost of installing and maintaining a plant.

HOPEWELL, N. J.—The Board of Freeholders has granted the Eureka Power Company permission to build a new line in Hopewell township, for furnishing electric service at Titusville and Washington's Crossing.

SALEM, N. J.—The Common Council is planning the installation of a new electric-driven pump at the city water station, Quinton.

TRENTON, N. J.—The Board of Public Utility Commissioners has granted the Electric Company of New Jersey permission to execute a mortgage for $5,000,000 to the Commercial Trust Company, trustee, and to issue bonds for $319,000 for extension work.

TRENTON, N. J.—The Public Service Electric Company has received a contract from the Westinghouse Electric & Manufacturing Company, for furnishing electric service for light and power at its new lamp works, now in course of construction on Pennington Avenue. The Westinghouse company has also arranged for the erection of a power house at the plant, about 50 by 100 feet, by the Stone & Webster Engineering Corporation.

BOYERSTOWN, PA.—The Borough Council has awarded a five-year lighting contract to the Boyerstown Electric Company.

HARRISBURG, PA.—The Harrisburg Light & Power Company will increase its capital by $250,000, or to $3,350,000, to provide for expansion. The company is planning the installation of new equipment at its station and line extensions. A meeting has been called for June 4 to ratify the capital increase and plans. H. W. Stone is secretary.

KINGWOOD, PA.—The Preston County Power Company has been incorporated with a capital of $5,000 by W. F. Schaeffer and C. C. Pierce, of Kingwood, and others, to furnish electric service here.

LANSFORD, PA.—The Panther Valley Electric Company is planning the construction of a new high-tension transmission line in connection with its local substation.

PHILADELPHIA, PA.—The Philadelphia Electric Company will build a nine-story addition to its building at Tenth and Chestnut Streets. The structure will be about 25 by 230 feet, and is estimated to cost $750,000.

POTTSVILLE, PA.—The Philadelphia & Reading Railroad is said to be planning the installation of electric loading machinery at its coal mines in northern Schuylkill County. A recent installation for experimental work has proved very successful.

READING, PA.—The City Council is considering the installation of a new fire-alarm and police-telegraph system to cost about $10,000.

READING, PA.—The Reading Transit & Light Company is planning improvements and extensions to cost about $200,000. The company has recently issued a report showing a net surplus in 1916 of $103,346.

RUTHERFORD, PA.—The Philadelphia & Reading Railroad will build a new engine and boiler plant at its local repair shops. Samuel T. Wagner, Philadelphia, is the engineer.

DOVER, DEL.—The Northern Central Company of Delaware, operating electric and gas properties, has been acquired by the Electric Bond & Share Company, in conjunction with Brown Brothers, bankers, of New York City. The new owners are said to be planning improvements and extensions in the plants and systems.

NEWARK, DEL.—The Common Council is considering proposals made by the Wilmington & Philadelphia Traction Company for furnishing electric service for municipal and other work. The Continental Fiber Company, Newark, has also tendered a proposition for supplying the service.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company is arranging for the early erection of an addition to its generating plant at Westport.

BALTIMORE, MD.—The Baltimore Car & Foundry Company, a subsidiary of the Standard Steel Car Company, Pittsburgh, will install a power plant at its car and structural steel works, now in course of construction at Curtis Bay, Anne Arundel County.

GRANTSVILLE, MD.—A contract has been made with the Boynton (Pa.) Electric Company to furnish electrical energy for street lighting and other purposes.

WASHINGTON, D. C.—The Potomac Electric Power Company will extend its underground distribution system in Sixth Street Northeast.

HARRISONBURG, VA.—The City Council has decided to spend $18,000 on the municipal hydroelectric plant. An additional unit will be added, doubling the present capacity. The power plant is located on the Shenandoah River, 14 miles east of the city.

NORFOLK, VA.—Preliminary arrangements are being made by City Manager Shertzer for the installation of a modern street-lighting system.

WHEELING, W. VA.—The West Virginia Traction & Electric Company, Morgantown, is building a new 13,000-volt transmission line to supply electric power in the coal-mining district.

CARY, N. C.—The City Council will construct a transmission line connecting with the Carolina Power & Light Company's power lines.

KELFORD, N. C.—A municipal electric-lighting plant may be installed here. J. E. Tyler is interested in the plans.

NORTH CENTRAL STATES.

BATAVIA, O.—The Batavia Light & Power Company has been incorporated by local men for the purpose of providing an electric plant for the town. The capital stock is $10,000. Allen B. Nichols, Eli H. Speidel, Percy F. Jamieson and others are interested.

CINCINNATI, O.—The Findlay Market Improvement Association, headed by President A. B. Heilemann, is endeavoring to secure electric lighting for the market by co-operative work among the local merchants.

CINCINNATI, O.—City Electrician Klein has completed plans and specifications for the proposed boulevard lighting system for the business section of the city. It is believed that arrangements for the letting of the contract will be made shortly.

DAYTON, O.—The Lindner Brothers Sanitary Milk Company will erect a new power plant in connection with its local factory.

HAMILTON, O.—City authorities are considering the steps necessary to put the municipal electric plant in first-class condition, and an expert will probably be employed to advise them on the subject. A considerable increase in the capacity of the plant is said to be needed.

LORAIN, O.—Work of replacing the Broadway distribution system of the Lorain County Electric Company, recent assignees of the franchise of the Citizens' Gas & Electric Company, which is to be begun in the near future, has been announced by officials of the company.

TOLEDO, O.—The Kuefer Power Transmission Company has been chartered with a capital of $100,000, by Anthony Kuefer, R. B. Wilson and others.

FRUITDALE, IND.—The Tipton-Frankfort Traction Company, of Tipton, Ind., is interested in the construction of an electric railway from Fruitdale to Brownstown. W. J. Davis, of Tipton, is in charge of the plans.

GARY, IND.—The Gary & Hobart Traction Company has filed articles of incorporation. The capital stock is $60,000, and William Earle, O. L. Wildermuth and Harlan Stratton are the incorporators. It is the purpose of the company to acquire or construct and operate street and interurban lines in and between Gary, East Gary, Chicago and Hobart, and to provide light, heat and power in and around these cities.

INDIANAPOLIS, IND.—The Terre Haute, Indianapolis & Eastern Traction Company is planning to extend its lines. I. R. Todd, of Indianapolis, is general manager.

ANCHOR, ILL.—The Anchor Electric Light Company has been incorporated to furnish electric service in this vicinity. Ed Riecks is interested in the company.

MILLEDGEVILLE, ILL.—Citizens here are contemplating the installation of an electric-lighting system, and $240 has been subscribed by the business men to pay the cost of a survey.

CALUMET, MICH.—Merchants here plan to secure improved street lighting in the business district.

DETROIT, MICH.—The Detroit Edison Company has begun active work in the development of its new power house at Bunce Creek. A gang of men has taken possession of the 1,000-foot river frontage at that point, has erected a tool house and begun to bore at various points on the property to determine the character of the soil for footings.

MONROE, MICH.—The Public Service Company, of this city, has applied for permission to incorporate and take over the municipal electric plant which was sold recently for $85,000 to the stockholders.

RED JACKET, MICH.—Plans are being discussed by local merchants for the installation of a white-way system in the business district.

KAUKAUNA, WIS.—The municipal electric and water department contemplates the construction of hydroelectric plant to develop 7,000 horsepower under a 26-foot head. W. B. Montgomery is manager of the department.

LITTLE FALLS, WIS.—The Little Falls Water Power Company plans the erection of numerous extensions to its distribution lines to give service to rural communities in this section.

DEER RIVER, MINN.—Contracts have been let for the construction of a new electric plant here. President Dungan, of the local company, states that most of the machinery has been purchased.

ST. PAUL, MINN.—The City Council will hold a hearing April 26 on a proposal to install an ornamental electric-lighting system in Eight Street, between Robert and Wabasha Streets, to cost about $4,000.

ANITA, IOWA.—The Anita Electric Light & Power Company has been sold to the Iowa Railway & Light Company, of Cedar Rapids and Perry, which concern recently purchased the plants at Adair, Menlo and Guthrie Center. The plans of this company are to extend its high-tension lines to the Missouri River.

CLEARFIELD, IOWA.—The Clearfield Electric Company, which has been in the hands of David G. Fisher & Company, of Davenport, has become a part of the system now called the Southern Iowa Utilities Company, with headquarters at Centerville. This company has lines to Seymour, Allerton and to other towns, energy being supplied from the plant at Mount Ayr.

MUSCATINE, IOWA.—Plans are being considered to secure improvements to the boulevard lighting system.

AURORA, MO.—An election probably will be held to vote on the issuance of $25,000 bonds to provide for a municipal electric-lighting plant.

DUDLEY, MO.—Electric service is to be furnished Dudley from the plant at Poplar Bluffs, Kans.

HOLDEN, MO.—An electric-lighting system will be installed here.

KIRKSVILLE, MO.—Bonds in the sum of $115,000 may be voted for proposed waterworks and electric-lighting systems.

SMITHVILLE, MO.—The local electric plant, owned by Harry Gordon and Crawford Morton, was completely destroyed by fire March 25, the loss being about $7,500. Smithville is now getting service from the McComas water power plant at Edgerton. The local plant may be rebuilt.

SPRINGFIELD, MO.—The Federal Light & Traction Company, A. F. Deinse, local manager, will build an addition to its plant costing about $350,000.

BENNINGTON, KANS.—The Riverside Company, of Abilene, is considering a plan to furnish energy for local distribution.

BRONSON, KANS.—Bonds in the sum of $15,000 may be voted for a municipal electric-lighting plant.

COFFEYVILLE, KANS.—Mayor Coverdale is to have a conference of business men in regard to establishing a municipal electric-lighting plant.

DENTON, KANS.—An electric-lighting system will be installed here. A transmission line may be built to Hiawatha to secure energy from the municipal plant there.

GENESEO, KANS.—Plans are being made here for an extension of an electric power line from Hutchinson to this city. The United Water, Gas & Electric Company, of Hutchinson, has a transmission line running to Lyons, and it may be extended on to Geneseo and Kenopolis, furnishing electric energy for the salt mines at Kenopolis.

HUTCHINSON, KANS.—A modern boulevard lighting system may be installed in this city.

McPHERSON, KANS.—The Water and Electric Department has received plans and specifications for the proposed improvements to the municipal electric plant. These include a new boiler and engine, bids for which will be asked at once.

PLEASANTON, KANS.—Plans are being made for erecting an electric-lighting system here.

SHARON, KANS.—An electric street-lighting system may be installed here.

CREIGHTON, NEB.—According to A. Honnegger, of Omaha, representing the Iowa Railway & Light Company and associated companies, it has been announced plans are being made for the installation of a large central station here, from which service will be supplied to Hartington, Bloomfield, Wakefield, Emerson and other towns in this section of the state.

EMERSON, NEB.—The Nebraska Electric Company, of Cedar Rapids, Iowa, has purchased the Emerson Light & Power Company. Henry Jensen, one of the original owners of the plant, remains with the new company as local manager.

INDIANOLA, NEB.—On April 17 voters here will vote on the issuance of $11,400 bonds for an electric-lighting system.

ALEXANDRIA, S. D.—At the annual election on April 17 the voters will have submitted to them the question of issuing bonds to the amount of $12,000 for the enlargement and improvement of the municipal electric light and power system.

KIMBALL, S. D.—Col. George W. Adams is promoting an electric railway to run from Kimball to Gann Valley, a distance of 20 miles.

LESTERVILLE, S. D.—The City Council will call an election to vote on the question of issuing additional bonds for municipal electric-lighting plant improvements.

ELLENDALE, N. D.—An explosion partially wrecked the plant of the Ellendale Light, Heat & Power Company, March 26. The loss is estimated at $1,000.

DATES AHEAD.

Tri-State Water and Light Association of the Carolinas and Georgia. Annual convention, Macon, Ga., April 17-19. Secretary, W. F. Steiglitz, Columbia, S. C.

Southwestern Electrical and Gas Association. Annual convention, Dallas, Tex., April 26-28. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

National Fire Protection Association. Annual meeting, Washington, D. C., May 8-10. Secretary-treasurer, Franklin H. Wentworth, 87 Milk Street, Boston, Mass.

Arkansas Association of Public Utility Operators. Annual convention, Pine Bluff, May 16-18. Secretary-treasurer, R. B. Fowles, Pine Bluff Company, Pine Bluff, Ark.

Missouri Association of Public Utilities. Annual convention, aboard Steamer Quincy en route from St. Louis, May 17-19. Secretary, F. D. Beardslee, 315 North Twelfth Street, St. Louis, Mo.

Electrical Supply Jobbers' Associations. Semi-annual meeting, Homestead Hotel, Hot Springs, Va., May 23-24. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

Iowa Section, National Electric Light Association. Annual convention, Des Moines, Iowa, May 24-25. Secretary, L. E. Caldwell, Iowa City, Iowa.

National Electric Light Association. Annual convention, Atlantic City, N. J., May 29-June 1. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York City.

Electric Power Club. Spring meeting, Homestead Hotel, Hot Springs, Va., June 11-14. Secretary, C. H. Roth, 1410 West Adams Street, Chicago, Ill.

American Institute of Electrical Engineers. Annual convention, Hot Springs, Va., June 26-29. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York City.

SOUTH CENTRAL STATES.

GREENVILLE, KY.—The Kentucky Utilities Company will shortly begin extensive repairs to its local power plant. The distribution system will be overhauled, and electric pumps installed at the waterworks and the ice plant.

HARTFORD, KY.—The City Council will shortly appoint a committee to confer with the Kentucky Light & Power Company as to a new contract for street lighting. The city, as the result of suspension of service, has been without lights for some time.

PADUCAH, KY.—The City Commission has given merchants on Broadway permission to erect a white-way system on that thoroughfare between Fourth and Fifth Streets.

RUSSELL, KY.—J. C. Vaughan, of Richmond, Va., is interested in an electric railway to be built from Russell to Ashland.

SEBREE, KY.—J. J. Korb, Henry Powell and L. W. Walden have purchased the local lighting plant from G. T. Carnal, together with the franchise, and will improve the property. Two new 25-horsepower oil engines, dynamos and other equipment have been purchased for the installation of a new plant.

WHITESBURG, KY.—W. W. Gibson & Son are planning to install an electric light and power plant here.

CENTERVILLE, TENN.—Frank Wilcox, engineer, St. Louis, Mo., will prepare plans for water works and electric-lighting systems here.

TREZEVANT, TENN.—The City Council is planning to expend $7,500 to install electric street-lighting units.

MARION, ALA.—The local electric-lighting plant was entirely destroyed by fire recently. It was owned by R. L. Ellis and others, of Selma, who probably will rebuild at once.

PARIS, ARK.—Winters & Dove, engineers, Ft. Smith, Ark., are making preliminary surveys for the installation of waterworks and electric-lighting systems here.

PINE BLUFF, ARK.—The Pine Bluff Company will extend its high-tension power transmission lines to Stuttgart and England, and plans to furnish electricity for other towns in that territory. Recently the company was authorized to increase its capital stock. Frank G. Bridges was elected president, H. C. Couch, vice-president, and Byron G. Fowles, secretary-treasurer.

MONROE, LA.—Voters here have approved a proposition to issue $612,000 in bonds for public improvements. The bonds will provide funds to rebuild the electric-lighting plant and other city works.

HEADRICK, OKLA.—The City Council contemplates the installation of an electric-lighting system.

HEALDTON, OKLA.—The Healdton Ice, Light, Power & Supply Company has been chartered with $15,000 capital stock by C. V. Miller and N. A. Jennings, of Healdton, and R. N. Martin, of Wirt, Okla.

MOUNTAIN PARK, OKLA.—The City Council is planning ways and means to secure a municipal electric-lighting system.

REMINY, OKLA.—The local electric plant has been sold to Smellweed & Swalle, of Bartlesville. The new owners have ordered $5,000 worth of machinery, and will put the plant in first class condition.

WOODWARD, OKLA.—The City Council is considering a proposition from the Woodward Cotton Company to sell its electric-lighting plant to the city.

COLUMBUS, TEX.—The Texas Motor Company has been granted a franchise to install an electric-lighting plant. E. C. Guilmartin is manager.

KAUFMAN, TEX.—The property of the Kaufman Electric Light Company has been acquired by the Texas Power & Light Company, with headquarters at Waco. W. E. McKennen will act as manager for the company here, which will operate the local plant until a transmission line can be built from Terrell to Kaufman.

SAN ANGELO, TEX.—The San Angelo Light & Power Company will build a dam across the Concho River for the purpose of forming a storage reservoir in connection with its waterworks system here.

SAN ANTONIO, TEX.—The Independent Electric Light & Power Company has been

incorporated here with a capital stock of $30,000, for the purpose of constructing and operating an electric light and power plant. W. L. Cunningham is a stockholder.

WACO, TEX.—Plans are being made to spend $13,000 for ornamental street-lighting units. E. F. Clopey is city electrician.

WACO, TEX.—The Texas Airline Interurban Railway Company has been incorporated, with principal offices here, for the purpose of constructing and operating five connecting lines of interurbans in this state. The proposed roads are to have an aggregate length of about 1,316 miles. The longest of the lines is to run between Beaumont and Corpus Christi, traversing the central and more southern part of the state, a distance of about 475 miles. Another proposed line is to run from Paris, near the northern boundary, to Palacios, on the Gulf coast, a distance of about 386 miles. From Eagle Lake a line is to be constructed up the valley of the Colorado River to Austin, about 90 miles. Another proposed line is to run between Navasota and Victoria, about 165 miles, and another between Houston and San Antonio, about 200 miles. The company has a nominal capital stock of $250,000. It is not publicly known what financial interest may be back of the ambitious project, but the stockholders, as named in the charter, are: J. D. Hunt, of Caldwell, Tex.; H. H. Hunt, of Columbus, Tex.; B. B. Hunt, of Waco, and William Tait, of Columbus.

WELLINGTON, TEX.—The plant of the Wellington Power & Light Company was destroyed by fire recently. A new plant will be built, to cost about $15,000.

WESTERN STATES.

DENTON, MONT.—Plans are under way for installing an electric-lighting plant in Denton. The Two Miracle Company, of Great Falls, Idaho, has applied for a franchise to erect the plant here.

SHERIDAN, WYO.—The Sheridan County Electric Company will spend during the next few months about $30,000 in improvements to its plant at Acme, according to Manager Judson Bibb. Plans include the installation of a 50-horsepower boiler and a 5,000-horsepower surface condenser, which have been purchased.

LITTLETON, COLO.—The Arapahoe Electric Light & Power Company has just completed a modern 11,000-volt transmission system through Arapahoe County for supplying the towns of Littleton, Englewood, Fort Logan, Sheridan and Petersburg, and at present is making extensive improvements to its distribution system. O. F. Nats is superintendent of the company.

MESA, ARIZ.—The City Council has come to an agreement with the South Side Gas & Electric Company for the purchase of the company's plant for $113,000. The proposition will be put to a vote of the people.

NOGALES, ARIZ.—Plans are under way for the lighting of Frank and Merley Avenues, Arroyo Boulevard and Park and Court Streets.

YUMA, ARIZ.—The Board of Supervisors has granted an electric light and power franchise to the Yuma Light, Gas & Power Company to extend its lines.

GRANTSVILLE, UTAH.—A hydroelectric plant, generating 210 horsepower, is to be built here by a company represented by C. F. Anderson and J. P. Ericson. The power will be used mainly for manufacturing purposes by the local potash plant and a number of mills in this vicinity. The plant will be located on North Willow Creek.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company is to rebuild the transmission line from the substation west of the city to the Jordan Narrows, in order that the city and towns to the south of the city may have improved electrical service. Work is to start on the building of the line as soon as the material is collected and the weather is favorable.

ALDERDALE, WASH.—The Alderdale Light & Water Company has been incorporated by William Warner, N. E. Lee and R. F. Simms with a capital of $25,000, to furnish electric service in this locality.

HOQUIAM, WASH.—A special election will be held here soon to bond the city for funds to condemn the electric light and power plant and construct a new one adequate to supply the needs of the district.

SEATTLE, WASH.—Bids are being received by the Board of Public Works for furnishing labor and material for the installation of another 7,500-kilowatt unit in the city's steam electric plant.

SEATTLE, WASH.—A mortgage for $4,500,000, covering all the power plants, substations, franchises and other properties in nineteen different counties, has been filed by the Idaho Power Company, which operates in Idaho and Oregon.

TEKOA, WASH.—Plans are under way for the construction of a municipal electric-lighting plant. A committee appointed by the City Council is getting estimates and investigating the feasibility of the plan.

PORTLAND, ORE.—The City Council has called an election for June 4, to vote on a $1,777,000 bond issue, to be used for the construction of a municipal electric-lighting plant. Hydroelectric engineers say that the amount is $1,000,000 short of being sufficient to install the type of plant proposed.

ATWATER, CAL.—An election will be held April 12 to vote on the question of forming highway lighting districts in unincorporated towns and villages within the county.

CHICO, CAL.—The establishment of a municipal lighting plant is being considered by the city authorities.

FALLBROOK, CAL.—The Board of Supervisors has called for bids for installing an electric-lighting system and furnishing energy for eight 250-candlepower series tungsten lamps in the Fallbrook public highway lighting district.

RIVERSIDE, CAL.—The Common Council has ordered the improvement of Main Street between Tenth and Fourteenth Streets, by the installation of an electric-lighting system.

SAN BERNARDINO, CAL.—Danon Cooley and V. K. McMains have applied to the State Railroad Commission for permission to build an $8,000 power plant and system in the Big Bear Valley. It is proposed to sell electricity at Pine Knot and Knight's Camp.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has taken over the Escondido Utilities Company and has placed Lester A. Wright in charge of the Escondido branch. A power line will be extended from Oceanside to supply energy to Escondido.

SAN FRANCISCO, CAL.—The Board of Public Works is receiving bids for furnishing and delivering underground material for the municipal railway system.

SANTA, ANA, CAL.—The City Council has decided to extend the ornamental lamps on North Main Street to the Santiago Creek bridge.

Financial Notes

A bill has been introduced in the Massachusetts Assembly to allow the Meriden Electric Light Company to increase its capital stock to $1,000,000.

The United Electric Light Company, of Springfield, Mass., has applied to the Gas and Electric Light Commission for authority to issue $500,000 in new capital stock, par value. The last issue of the company's stock was at $185 per share. A hearing will be held April 12 on the petition.

An extra dividend of one per cent, in addition to the regular two per cent quarterly dividend on the common stock, was declared on March 29 by the directors of the Crocker-Wheeler Company for the quarter ending March 31. The regular quarterly dividend of 1.75 per cent was declared on the preferred stock.

The Birmingham (Ala.) Railway, Light & Power Company will ask the stockholders to authorize and consent to the issue of $2,000,000 in notes on April 26. This issue will provide for the cost of taking over the Tidewater Railroad, which was approved by the courts recently. The notes will bear six-per-cent interest and will mature in 1919. In addition to consenting to the issue, the stockholders will be asked to provide a trustee for the $2,000,000, and to attend to other matters.

Gross earnings of the Commonwealth Power, Railway & Light Company, Jackson, Mich., for the month ending February 28, according to the earnings statement, was $1,530,735.01, an increase of 12.31 per cent over the previous month. The operating expenses were $838,962.77, an increase of 31.57 per cent. The net earnings were $691,772.24, a decrease of 4.63 per cent, and the net profits $174,408.87, a decrease of 28.89 per cent. More than $100,000 more was paid for coal in February, 1917, than in February, 1916, due, to a considerable extent, according to the statement, to the failure to receive deliveries on contracts.

The Public Service Corporation of New Jersey in its annual report for 1916 shows an increase in operating income for its three subsidiaries of 13.6 per cent, with a total operating income of $42,548,775.10, or increase of $5,077,546.88 over the previous year. Operating expenses, including amortization, charges and taxes, aggregated $25,863,854.24. The net increase in

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

	Div. Rate Per cent	Bid Mar. 26	Bid Apr. 2
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	....	26	26
Adirondack Electric Power of Glens Falls, preferred	6	83	82½
American Gas & Electric of New York, common	10+extra	138	137
American Gas & Electric of New York, preferred	6	50	51
American Light & Traction of New York, common	....	358	360
American Light & Traction of New York, preferred	6	112	112
American Power & Light of New York, common	4	84	84
American Power & Light of New York, preferred	6	90	89
American Public Utilities of Grand Rapids, common	....	35	36
American Public Utilities of Grand Rapids, preferred	6	69	69
American Telephone & Telegraph of New York	....	127¼	125
American Water Works & Elec. of New York, common	....	12½	12¼
American Water Works & Elec. of New York, particip	7	33	31
American Water Works & Elec. of New York, first preferred	....	83	80
Appalachian Power of Bluefield, common	....	6½	6½
Appalachian Power of Bluefield, preferred	7	37	37
Cities Service of New York, common	6+extra	293	292
Cities Service of New York, preferred	6	90	89¾
Commonwealth Edison of Chicago	8	136½	137
Comm. Power, Railway & Light of Jackson, common	4	57	57
Comm. Power, Railway & Light of Jackson, preferred	6	80	80
Federal Light & Traction of New York, common	....	14	12½
Federal Light & Traction of New York, preferred	....	50	50
Illinois Northern Utilities of Dixon	6	80	80
Middle West Utilities of Chicago, common	2+2 extra	58	58
Middle West Utilties of Chicago, preferred	6	77½	77½
Northern States Power of Chicago, common	7	99	98¾
Northern States Power of Chicago, preferred	7	98	98¾
Pacific Gas & Electric of San Francisco, common	5	66	64¾
Pacific Gas & Electric of San Francisco, preferred	6	92½	91
Public Service of Northern Illinois, Chicago, common	7	109	110
Public Service of Northern Illinois, Chicago, preferred	6	101¾	101½
Republic Railway & Light of Youngstown, common	4	41	37½
Republic Railway & Light of Youngstown, preferred	6	71	69
Standard Gas & Electric of Chicago, common	....	12¾	12¾
Standard Gas & Electric of Chicago, preferred	6	39½	39½
Tennessee Railway, Light & Power of Chattanooga, common	....	7	7½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	34	34
United Light & Railways of Grand Rapids, common	4	46	47
United Light & Railways of Grand Rapids, preferred	6	75	75
Western Power of San Francisco, common	....	16½	15
Western Power of San Francisco, preferred	6	63	60
Western Union Telegraph of New York	5+ extra	96	97
Industrials—			
Electric Storage Battery of Philadelphia, common	4	65	63
General Electric of Schenectady	8	165	165½
National Carbon of Cleveland, common	8	†300	†300
National Carbon of Cleveland, preferred	7	†135	†135
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	50⅜	52½
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	†71	70

†Last Sale.

surplus, prior to payment of dividends, was $2,947,693.57. The increase in receipts of the three companies over 1915 was as follows: Public Service Electric Company, 22.9 per cent; Public Service Railway Company, 9.7 per cent, and Public Service Gas Company, 10.3 per cent. A total of $88,368.33 was expended for welfare work, sick benefits and pensions, and $77,436.40 for accidents, this latter being over $7,000 more than required by the state workmen's compensation law. The company operates in 218 municipalities in the state.

Reports of Earnings.

AMERICAN POWER & LIGHT SUBSIDIARIES.

The gross and net earnings from operation of all subsidiary operating companies now controlled by the American Power & Light Company, inter-company charges eliminated for February and the 12 months ended February 28, 1917, as compared with the earnings for the same periods the previous year, were as follows:

	1917	1916
February gross	$ 806,362	$ 733,048
Net earnings	344,713	338,601
Twelve months' gross	8,651,013	7,930,584
Net earnings	3,942,703	3,634,898

The earnings as shown above were the earnings from operation of the properties of subsidiary companies and not the earnings of the American Power & Light Company.

PHILADELPHIA ELECTRIC.

The electric light and power department of the Philadelphia Electric Company reported earnings for February and for the 11 months ended February 28, 1917, as follows:

	1917	1916
February gross	$ 689,564	$ 558,186
Net after taxes	285,557	298,550
Eleven months' gross	6,592,324	5,180,136
Net after taxes	2,718,886	2,588,175

UTAH SECURITIES CORPORATION.

The Utah Power & Light Company, the principal operating subsidiary of Utah Securities Corporation, reported as follows for February and the 12 months' ended February 28, 1917:

	1917	1916
February gross	$ 401,028	$ 327,875
Net after taxes	213,728	171,546
Surplus after charges	100,390	76,001
Twelve months' gross	4,452,266	3,716,066
Surplus after charges	1,130,762	843,668

Incorporations

INDIANAPOLIS, IND. — Indianapolis Electric Supply Company has increased its capital from $70,000 to $150,000.

CHICAGO, ILL.—Russell Electric Company. Capital, $2,500. Incorporators: S. I. Russell, T. C. Russell and R. E. Church.

CHICAGO, ILL.—Dynelectric Company. Capital, $100,000. Incorporators: George S. Foster, William L. Lahey and E. L. George.

BOGOTA, N. J.—Krause & Vix, Incorporated. Capital, $10,000. Electrical engineers. Incorporators: G. Vix, Jr.; C. Krause and L. Dineser.

NIAGARA FALLS, N. Y.—Prospect Electric Company. Capital, $10,000. Electrical contracting. Incorporators: H. J. Willis, A. Rix and W. A. Rix, Buffalo.

CLEVELAND, O.—Merrell-Sharp Electric Company. Capital, $10,000. Incorporators: G. Q. Kelley, A. J. McClure, M. E. Atkinson, F. A. Cook and G. E. Buckheit.

NEW YORK, N. Y.—Herman Robinson, Inc. Capital, $3,000. Electrical contracting, etc. Incorporators: Herman Robinson and others, 509 Grand Street, New York.

NEW YORK, N. Y.—Foote, Pierson & Company. Capital, $100,000. Electrical machinery and contracting work. Incorporators: W. R. Stout, M. N. Liebmann and N. G. Pierson, 160 Duane Street.

DOVER, DEL.—Consumers' Electrical Company. Capital, $50,000. Electrical engineering, contracting and constructing. Incorporators: F. C. Ross and Charles C. Helmer, Carroll, Iowa, and C. H. Utter, Grinnell, Iowa.

DOVER, DEL.—Southern Arizona Utilities Company. Capital, $200,000. To operate generating plants for electric light, heat and power. Incorporators: S. B. Howard, Harry B. Davis and A. W. Britton, all of New York City.

OSHKOSH, WIS.—Convex Electric Sign Company, with Delaware charter. Capital, $100,000. To manufacture electric signs. Incorporators: W. M. Bray, Oshkosh; Carl B. Rox, Milwaukee, and Herbert E. Latter, Wilmington, Del.

WILMINGTON, DEL.—Eureka Electric Indicator Company. Capital, $100,000. To manufacture electric indicators, signals, etc. Incorporators: R. H. Churchill, Wilmington; Edward E. Brent, Lawnside, N. J.; J. Burrell and Isadore Martin, Philadelphia, Pa.

Proposals

MOTOR-DRIVEN PUMPS.—Bids will be received until May 1 by Michael Baker, Borough Engineer, Beaver Falls, Pa., for two 1,000,000-gallon motor-driven centrifugal pumps, to be installed in the town of Monaca, Pa.

ELECTRIC CABLES AND WIRE.—Proposals will be received until May 1 by the United States Engineer's Office, Detroit, Mich., for furnishing electric cables and wire, to be delivered to Sault Ste. Marie, Mich. Further information can be obtained on application to the above-named office.

ELECTRICAL WORK.—Proposals will be received until April 25 by the Board of Commissioners, Hamilton County, Cincinnati, O., for the construction of a power plant at the site of the Longview Hospital in Cincinnati. Drawings and specifications may be obtained from Elzner & Anderson, architects, Ingalls Building, Cincinnati, or from Albert Reinhardt, secretary of the New Longview Hospital Buildings Commission, Courthouse, Cincinnati.

ELECTRICAL SUPPLIES.—Bids will be received at the Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., for furnishing supplies at the following naval stations: Schedule 867, Mare Island, Cal., 30 electricians' pocket tool kits. Schedule 878, Philadelphia, Pa., 100,000 duct feet of vitrified clay conduit. Schedule 879, Charleston, S. C., two sets of storage batteries. Schedule 886, Philadelphia, Pa., two generating sets. Bidders desiring to submit proposals should make application to the Bureau or to the nearest navy yard purchasing office.

New Publication

ENGINEERING WORK OF UNIVERSITY OF ILLINOIS.—A special brief has been published in the form of a 28-page book concerning the work of the College of Engineering and the Engineering Experiment Station of the University of Illinois. This has been prepared by the dean and heads of the various departments, and explains the work that has been and is being carried out, and gives a statement of the needs of the institution to carry on this work properly and adequately during the next few years.

Electrical Patents Issued March 27, 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,220,165. System of Electric Distribution. V. G. Apple, assignor to Apple Electric Co., Dayton, O. Connections of storage battery and dynamo in starting and ignition circuits for interval-combustion engines.

1,220,166. Variable Magnetic-Opposed Reaction-Coil Electric Circuit. I. E. Aske, Duluth, Minn., assignor to Aske Automatic Voltage Regulator Co. Structure and connections of reactance for distribution of voltage in magneto lighting circuit.

1,220,168. Outlet-Box. A. W. Baker, Danbury, Conn. Structure of device for connection to conduits of various sizes.

1,220,174. Padlock-Switch. S. F. Briggs, assignor to Briggs & Stratton Co., Milwaukee, Wis. For automobiles.

1,220,220. Electric-Switch Mechanism. D. D. Gordon, assignor to Yost Electric Mfg. Co., Toledo, O. For lamp sockets.

1,220,228. Telephony. D. S. Hulfish, assignor to Canadian Independent Telephone Co., Ltd., Toronto, Canada. Grouping, etc., of lines in an automatic system.

1,220,235. Electric Heater. E. Keen, assignor to Aladdin Lamp Corp., New York, N. Y. Has support of bent wire for heat-unit and article to be heated.

1,220,238. Quadruplex Telegraphy. I. Kitsee, assignor to American Telephone & Telegraph Co., New York, N. Y. Arrangement of lines and transmitters.

1,220,255. Electrical Regulator. F. W. Merrill, Chicago, Ill. Variable resistance wherein high and low resistors are vertically movable in a liquid receptacle.

1,220,262. Water Electrolyzing Apparatus. R. J. Mueller and E. G. Rowlands, Sheboygan, Wis., assignors to Universal Oxygen Co. Structure of cell.

1,220,277. Current-Generator and Spark-Distributer. D. E. Ross, La Fayette, Ind. For internal-combustion engines; special structure and driving connections of generator with provision for adjusting time of current impulse with relation to piston position.

1,220,317. Combined Car and Electric Coupling. T. R. Brown, assignor to Westinghouse Air Brake Company, Wilmerding, Pa. Has contacts controlled by the release of the lock for the coupler-head.

1,220,323. Pneumatic Retrieving Trolley. A. M. Eaton, Santa Monica, Cal. Structure of pneumatic device mounted on pole base.

1,220,326. Connecting Device. A. H. Fargo, assignor to C. Tremain, Wilmington, Del. Details of plug and socket connection. (See cut.)

1,220,333. Insulator-Clamp. E. G. Hatch, Hoboken, N. J. For tieing a wire into a groove in the top of an insulator.

1,220,340. Time-Service-Controlling Mechanism. J. R. Jackson and F. H. Davis, assignors to W. H. Thompson, Memphis, Tenn. Clock-controlled contact-device.

No. 1,220,326.—Connection Device.

1,220,341. Make-and-Break Controlling Device. J. R. Jackson and F. H. Davis, assignors to W. H. Thompson. Modification of above.

1,220,342. Closing-Device for Electric Circuits. W. A. Kilmer, assignor to American Steel & Wire Co., Hoboken, N. J. Mechanism for operating switches in sequence by an endless sprocket chain.

1,220,370 and 1,220,371. Constant-Voltage System. T. Spencer, assignor to Helios Mfg. Co., Philadelphia, Pa. Structure and arrangement of exciter and field members of a generator.

1,220,377. Machine for Making Insulating Elements. C. H. Thordarson, Chicago, Ill. For forming a multiply structure of thin, impregnated sheets.

1,220,378. Machine for Making Insulating Elements. C. H. Thordarson, Chicago, Ill. For assembling thin sheets to constitute multiply insulating element.

1,220,384. Renewable Fuse. E. H. Wilson, Chartiers Township, Allegheny County, and W. F. Clark, Coraopolis, Pa. Clamping devices for ends of enclosed fuses.

1,220,414. Electric-Switch Mechanism. D. D. Gordon, assignor to Yost Electric Mfg. Co., Toledo, O. Two-push-button snap.

1,220,433. Electromagnet. C. L. Krum and H. L. Krum, assignors to Morkrum Co., Chicago, Ill. Structural details.

1,220,472. Spark-Plug. E. L. Suess, Pittsburgh, Pa. Structural details.

1,220,484. Centrally-Controlled General Alarm System. F. W. Wood, assignor to C. Cory & Son, Inc., New York, N. Y. Switching mechanism for the alarm circuit is operated by an electrically controlled motor.

1,220,486. Self-Excited Direct-Current Dynamoelectric Machinery. P. Amsler, assignor to Aktiengesellschaft Brown Boveri & Cie, Baden, Switzerland. Has specially proportioned thin iron projections extending into the air gap between pole face and armature.

1,220,493. Fire-Alarm and Multiple-Circuit Closer. J. A. Bunch, Adams, Ore. Details of structure operated by expansible device.

1,220,501. Sound Amplifier. W. W. Dean, assignor to Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y. Inertia microphone is mounted on end of rod having hardened steel point for pressing against object.

1,220,508. Electric Heater. R. R. Grimshaw and L. M. R. Jones, Findlay, O. Air-heater for mounting in conduit.

1,220,509. Station-Indicator. H. S. Halton, Ridgeway, Canada. Endless chain of station cards is electrically controlled and operated.

1,220,523. Suspending Device for Trolley-Wires. W. A. McCallum, Terrace Park, O. Details of ear comprising a two-part clamp.

1,220,546. Controlling Mechanism for Fluid Compressors. O. H. Pieper and A. F. Pieper, Rochester, N. Y. Pressure-operated switch.

1,220,569. Switch. H. A. Steen, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Structure of device having main and auxiliary contacts with magnetic blow-out.

1,220,573. Rheostat. H. A. Wallace, assignor to Union Switch & Signal Co., Swissvale, Pa. Has girds of wire trained through perforations in insulating plates.

1,220,587. Electrical Measuring Instrument. W. E. Beede, New York, N. Y. Indicating instrument of d'Arsonval type has adjustable magnetic members for correcting readings.

1,220,596. Method of Manufacturing Electrical Conductors. W. P. Boyard, assignor to Ohio Brass Co., Mansfield, O. Manner of securing terminals to ends of flexible, laminated conductors of large current capacity.

1,220,598. Electric Welder. E. A. Buckman, Walkerville, Canada, assignor of one-half to E. H. Sellers. Spot-welder.

1,220,603. Storage-Battery Construction. D. J. Cartwright, South Bethlehem, Pa. Structure of container and plate-support.

1,220,604. Storage-Battery Plate. D. J. Cartwright, assignor to U. S. Light & Heat Corp., Niagara Falls, N. Y. Structure of Plante plate.

1,220,607. Testing Arrangement. H. P. Clausen, assignor to Western Electric Co., New York, N. Y. For testing for unstandard conditions in the multiple of a telephone exchange system.

1,220,608. Electric Fitting. J. Cuthbert, Chicago, Ill. Details of receptacle block.

1,220,617. Fishing Signaling Apparatus. L. D. Evans, Hearne, Tex. Tug on the line lights lamp on pole.

1,220,627. Automobile-Thief Alarm. W. H. Hanssen, assignor to V. J. Scholtz, Denver, Colo. Movement of controller arm short-circuits ignition and sounds alarm.

1,220,634. Portable Electric Light. C. Hubert, Hewlett, N. Y. Details of flash-light.

1,220,646. Circuit-Closer for Fire-Alarms. S. J. Kranyak, Duluth, Minn. Structure of contact device in which contacts are held open by fusible insulation.

1,220,654. Line-Support. Truman R. Lott, Houston, Tex. Details of extensible strut.

1,220,655. Heater. S. J. Lukaszewski, Detroit, Mich. Details of hydrocarbon burner having electric ignition.

1,220,669. Cusp-Diaphragm Mechanism. F. E. Miller, New York, N. Y. For telephone receiver.

1,220,678. Electric-Light Sign. T. H. Peery, Brunswick, Mo. Has interchangeable heads, each having a letter formed of incandescent lamps.

1,220,679. Electrical Contact. C. Pfeiffer, assignor to Allen-Bradley Co., Milwaukee, Wis. Is formed of an elastic carbonaceous material in a container so treated as to maintain contact under temperature changes.

1,220,701. Circuit-Closer for Track Switches. C. W. Squires, Beverly, Mass. Structural details.

1,220,715. Primary Terminal. C. W. Beck, Detroit, Mich., assignor to Beck-Frost Corp. Structure and manner of securing terminal.

1,220,721. Automatic-Release Mechanism. L. Bradley and H. L. Bradley, Milwaukee, Wis. Tripping mechanism for circuit-breakers in polyphase circuit.

1,220,752. Manufacture of Sulfuric Acid. W. J. Kee, Jr., Kansas City, Kans., and U. Wedge, Ardmore, Pa. Sulfur dioxid is converted in sulfur trioxid by subjecting to electric discharge.

1,220,756. Quadruplex Telegraphy. I. Kitsee, assignor to American Telephone & Telegraph Co. Reversals are impressed on line for no signal condition, signal sent by current of one polarity and signal cessation indicated by momentary impulse of opposite polarity.

1,220,763. Regulating Arrangement for Dynamoelectric Machines. J. Martin, assignor to General Electric Co. Schenectady, N. Y. Manner of interconnecting secondaries of pair of induction motors having their primaries connected with line. (See cut.)

1,220,770. Method of Electrical Welding. T. E. Murray, New York N. Y. Manner of forming a welded joint between tubes at right angles.

1,220,771. Method of Making Crank-Shafts. T. E. Murray. Arm is electrically welded to pin and shaft.

1,220,772. Method of Welding a Threaded Tube in a Sleeve or Ferrule. T. E. Murray. Externally threaded tube is welded to an internally threaded sleeve having an internal rib.

1,220,773. Method of Producing Solid Ribs on Sheet-Metal Tubes. T. E. Murray. Sections of flanged tubes have their flanges welded together.

1,220,774. Method of Electrical Welding. T. E. Murray. For forming a seam in a cylinder of thin metal.

1,220,775. Gear-Wheel. T. E. Murray. Body formed of struck-up portions of sheet metal electrically welded together and teeth welded to rim.

1,220,779. Electrical Plug-Switch. E. J. Ovington, assignor to Simplex Electric Heating Co., Cambridge, Mass. Connector switch with contacts controlled by relative rotation of its parts.

1,220,780. Electrical Connector. E. J. Ovington, assignor to Simplex Electric Heating Co. Details of device having tubular insulating casing with conductor receiving terminals.

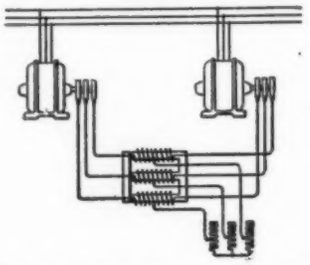
1,220,781. Electric Heating Device. L. F. Parkhurst, assignor to General Electric Co. Details of portable stove.

1,220,800. Trolley-Pole Wheel. J. F. Trust, Hagerstown, Md. Simple structure of hasp and guard.

1,220,802. Starter System and Apparatus for Combustion Engines. R. Varley, Englewood, N. J. Motor is prevented from connection with engine when armature is moving.

1,220,813. Protective Device for Electric Distributing Systems. C. J. Barrow, assignor to General Electric Co. Special structure of electromagnetic switch.

1,220,826. Relay. J. T. Dempster, assignor to General Electric Co. Comprises electric-energy motor-meter element and



No. 1,220,763.—Regulating Attachment for Dynamoelectric Machines.

indicating electric-meter element and contacts jointly controlled thereby.

1,220,833. Measuring Instrument. H. A. Ewen, assignor to Marconi Wireless Telegraph Co., New York, N. Y. Current indicator has pointer moved by tension on filaments exerted by magnetic member electromagnetically moved longitudinally of its axis.

1,220,836. Filament-Support Wire-Inserting Machine. T. W. Frech, Jr., and J. T. Fagan, assignors to General Electric Company. For use in making incandescent lamps.

1,220,839. Method of Making Furnace-Hearths. J. H. Gray, New York, N. Y. Pyro-conductive material is built up into place while kept heated into pasty condition by electric arc.

1,220,842. Combination Electric Lock-Switch. R. O. Hammond, assignor to Bernard Urdang, Paterson, N. J. Has combination of centrally mounted levers moving over circle of contacts.

1,220,848. Electric Welding Apparatus. H. S. Holmes, Brooklyn, N. Y. Has connection for welding current controlled by movement of electrode.

1,220,886. Tungsten Contact-Point. C. A. Pfanstiehl, Waukegan, Ill., assignor to Pfanstiehl Co. Has grain of metal perpendicular to contact face.

1,220,912. Wire-Clamp. J. Walker, Wolf Lake, Ill. Details of structure for securing wires to walls.

1,220,920. Wireless Sounder. A. J. Williams, Covington, Ky. Structural details of receiving apparatus.

1,220,954. Circuit-Closer for Drip-Pan Alarms. J. J. Chapman, Indianola, Miss. Details.

1,220,971. Apparatus for Controlling the Voltage in Variable-Speed Illuminating Dynamos. E. Fuchs, assignor to L. Renault, Billancourt, France. Structure of core and armature of electromagnetic contact device.

1,220,981. Indicator. J. I. Gungle, Ann Arbor, Mich. Electromagnetically operated direction-indicator.

1,220,993. Plug and Socket Connector. J. Sachs, assignor to Hart & Hegeman Mfg. Co., Hartford, Conn. The shell is contracted upon the plug when latter is inserted.

1,220,997. Combined Spot and Butt Welder. E. Thomson, assignor to Thomson Spot Welder Co., Boston, Mass. Has electrodes for either character of welding connected with same transformer secondary.

1,221,006. Cable-Guard. G. B. Wessel, St. Louis, Mo., assignor of one-half to J. H. Luebert, St. Louis, Mo. Cradle for supporting cable from messenger in an integral metal sheet.

1,221,007. Headlight. F. W. Dressels, assignor to the Dressel Railway Lamp Works, New York. Reflector arrangement.

PATENTS EXPIRED.

The following United States electrical patents expired on April 3, 1917:

646,418. Machine for Generating and Utilizing Static Electricity. W. Dodd and A. D. Struthers, Des Moines, Iowa.

646,454. Track-Circuit Closer. S. L. Neely, Pierron, Ill.

646,460. Trolley. W. B. Potter, Schenectady, N. Y.

646,467. Motor Frame. S. H. Short, Cleveland, O.

646,476. Carbon Brush. E. Thomson, Swampscott, Mass.

646,485. Reversing and Cutout Switch. T. von Zweigbergk, Cleveland, O.

646,500. Electric Transformer. W. S. Moody, Schenectady, N. Y.

646,526. Electric Controller. J. C. Lincoln, Cleveland, O.

646,552. Storage Battery. G. W. Gesner, New York, N. Y.

646,598. Relay. L. Cerebotani, Munich, Germany.

646,619. Electric Metal-Working Apparatus. C. L. Coffin, Detroit, Mich.

646,626. Surface-Contact Railway System. G. Paul, Munich, and H. Wriggers, Augsburg, Germany.

646,643. Instrument for Measured-Service Telephones. C. E. Gierding, West Haven, Conn.

646,675. Telephone-Exchange System. E. E. Clement, Washington, D. C.

646,676. Combined Annunciator and Spring Jack. E. E. Clement, Washington, D. C.

646,677. Telephone-Exchange System. E. E. Clement, Washington, D. C.

646,678. Telephone Transmitter. E. E. Clement, Washington, D. C.

646,679, 646,680, 646,681, 646,682 and 646,683. Telephone-Exchange System. E. E. Clement, Washington, D. C.

646,688. Device for Shifting Electric Current from One Conductor to Another. W. D. Gharky, Philadelphia, Pa.

646,689. Telephone System. W. D. Gharky, Philadelphia, Pa.

646,690. Intercommunicating Telephone System and Apparatus. W. D. Gharky, Philadelphia, Pa.

646,691. Circuit Protective Device. W. D. Gharky, Philadelphia, Pa.

646,692. Telephone-Exchange System. W. D. Gharky, Philadelphia, Pa.

646,693. Annunciator and Spring Jack. W. D. Gharky, Philadelphia, Pa.

646,694, 646,695, 646,696 and 646,697. Telephone-Exchange System. W. D. Gharky, Philadelphia, Pa.

646,701. Plug Seat for Telephone Switchboards. A. K. Keller, Philadelphia, Pa.

646,714. Railway Signal. H. B. Taylor, Newark, N. J.

646,717, 646,718 and 646,719. Railway Signal. J. Wayland and H. B. Taylor, Newark, N. J.

646,721. Electrical Indicator for Elevators. W. H. Baker, Central Falls, R. I., and F. E. Kip, Montclair, N. J.

646,742. Electric Bond for Street Mains. A. A. Knudson, Rutherford, N. J.

646,744. Branch or Lamp Switch. E. Liebscher, Nuremberg, Germany.

646,768. Controlling Apparatus for Electric-Railway Cars. A. Sundh, Yonkers, N. Y.

646,793. Medical Galvanic Battery. H. Bentz, New York, N. Y.

646,839. Service Switch for Electric-Lighting Systems. G. O. Kelly, Cambridge, Mass.

646,858. Vacuum-Tube Light. D. M. Moore, Newark, N. J.

646,867. Igniter for Gas Engines. O. Owens, San Francisco, Cal.

646,883. Electric Arc Lamp. P. H. F. Spies, Yonkers, N. Y.

646,886 and 646,887. Electric-Signaling Device for Hydraulic Hose. B. L. Stowe and J. J. Voorhees, Jersey City, N. J.

646,889. Controller for Electric-Railway Cars. A. Sundh, Yonkers, N. Y.

646,894. Storage Cell. H. J. Cogswell, Hartford, Conn.

646,911. Electric Heater. G. S. Knox, Philadelphia, Pa.

646,922. Storage Battery. E. A. Sperry, Cleveland, O.

646,923. Cellulose Envelope for Elements of Storage Batteries. E. A. Sperry, Cleveland, O.